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ACTIVITIES OF THE HEALTH AND SAFETY DIVISION, BUREAU OF MINES UNITED STATES DEPARTMENT OF THE INTERIOR DURING THE WAR YEARS, 1941-45

BY

D. HARRINGTON

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ACTIVITIES OF THE HEALTH AND SAFETY DIVISION, BUREAU OF MINES, UNITED STATES DEPARTMENT OF THE INTERIOR DURING THE WAR YEARS, 1941-45[1]

By D. Harrington[2]

FOREWORD

Virtually all government agencies undertook many additional responsibilities during the period immediately preceding World War II; these responsibilities increased vastly in importance and scope after the actual declaration of war following the attack on Pearl Harbor. The Bureau of Mines was one of the agencies thus affected, and it was called upon to perform many duties foreign to its normal peacetime activities.

The Health and Safety Division of the Bureau of Mines, at that time designated the Health and Safety Branch, was given several important and difficult duties and responsibilities of an unusual nature because of the war while of necessity continuing its normal functions of assisting the mineral industries in the preservation of life and health and the protection of property, this being of especial importance in wartime because of the pre-eminent importance of having maximum output of essentially all types of mineral products. Some of these additional functions were given to the Health and Safety Division because the organization of the Division, with its field set-up dividing the Nation into districts with competent, experienced personnel in charge of its work, provided the nucleus of personnel and procedure through which rapid and smooth expanded functioning was feasible.

In addition to the responsibilities directly attributable to definite war activities, such as the administration of the wartime Federal Explosives Act and the Mineral Production Security Branch, a new branch (then designated division) was formed to investigate coal-mine health and safety problems after the enactment of the Federal Coal-Mine Inspections and Investigations Act, which became a law on May 7, 1941, but which actually began to function actively after the declaration of war in December 1941.

The purpose of this publication is to provide a brief historical record of the activities of the Health and Safety Division as a whole and of its individual branches during the war. The detailed record has been filed in the Archives Building, Washington, D. C.

1/ The Bureau of Mines will welcome reprinting of this paper, provided the following footnote acknowledgment is used: "Reprinted from Bureau of Mines Information Circular 7487."

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Much of the work of abstracting and preparing this manuscript for publication was done by S. M. Walker, mining engineer, Safety Branch, Bureau of Mines.

ORGANIZATION OF HEALTH AND SAFETY WORK

When the Bureau of Mines was created in 1910, the organic act had as one of its main provisions the following:

> That it shall be the province of said bureau and its director, under the direction of the Secretary of the Interior to make diligent investigation of methods of mining, especially in relations to the safety of miners, and the appliances best adapted to prevent accidents, the possible improvement of conditions under which mining operations are carried on, the treatment of ores and other mineral substances, the use of explosives and electricity, the prevention of accidents, and other inquiries and technologic investigations pertinent to said industries, and from time to time make such public reports of the work, investigations, and information obtained as the Secretary of said department may direct, with the recommendations of such bureau.

The first annual report of the Director of the Bureau of Mines, issued in 1911, states:

> The Bureau of Mines was established by an act of Congress (36 Stat., 369) approved May 16, 1910, and effective July 1, 1910. The demand for special recognition and aid from the Federal Government for the mining industry had been increasing for a number of years, especially among the metal-mining interests in the Western States, and from time to time bills looking to the creation of a national bureau or department of mines have been introduced in Congress by representatives of those States. At the time of the passage of the act establishing the bureau, however, the factors that were most effective in calling attention to the advisability of action by the Government were disasters in coal mines and a growing realization of the waste of both life and resources in the varied mining and metallurgical industries of this country.

Hence, from the earliest period of the existence of the Bureau of Mines, one of the main objectives of the Bureau's work was the prevention of loss of life and limb and the protection of the health of those who make available the mineral products that are one of this country's most important sources of greatness as a nation and which assume even greater importance in time of war. During the years that have intervened since the Bureau of Mines came into existence in 1910, the Bureau has consistently and continuously conducted a campaign, primarily educational, designed to achieve the above-mentioned objectives; educational procedures are used partly because the Bureau of Mines has no legal authority to enforce suggestions or recommendations as to health, safety, or efficiency, but chiefly because it is believed that if those engaged in the mining industry are kept informed as to what can or

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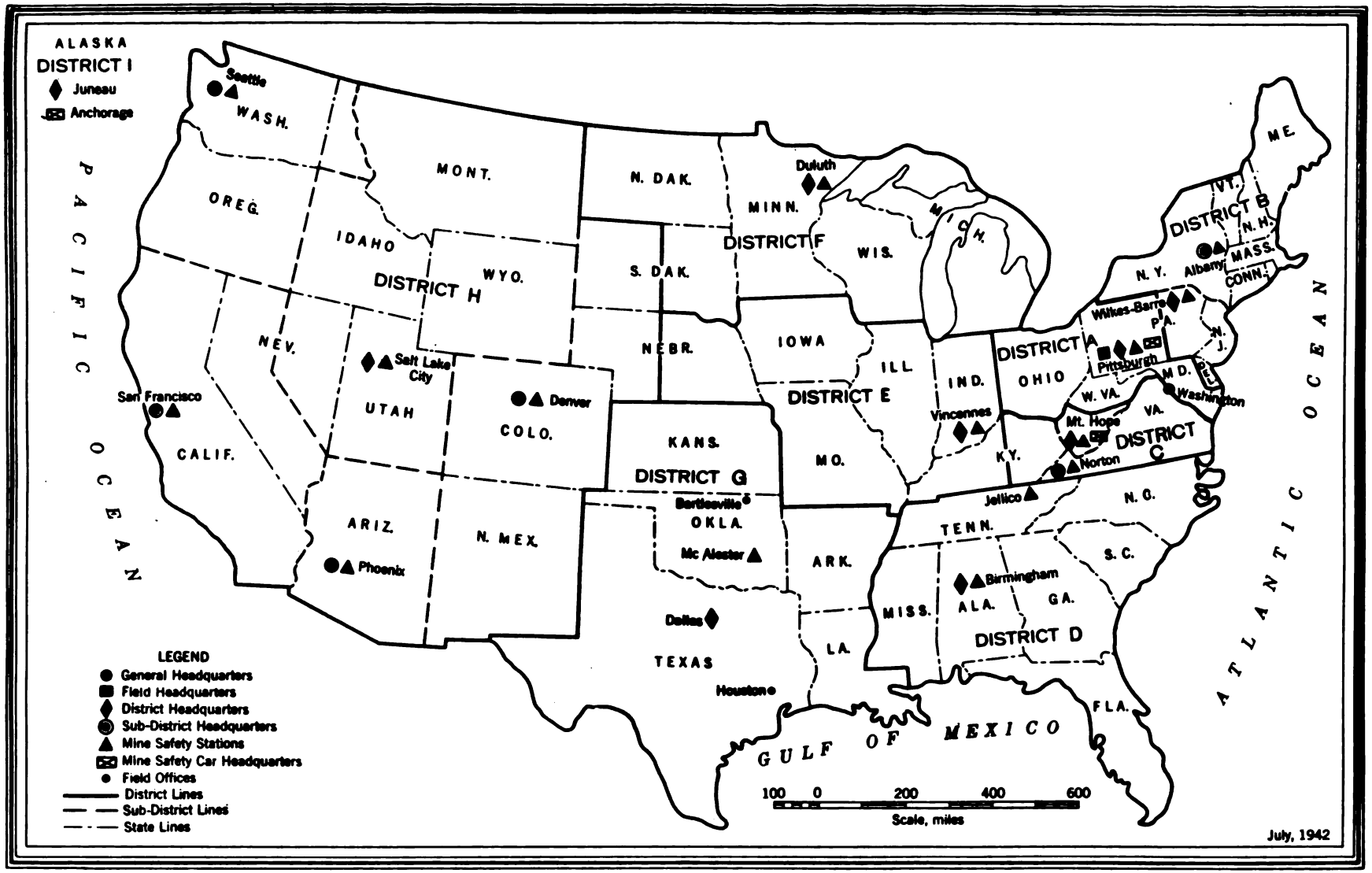

Figure 1. - Map of the United States showing general headquarters, field headquarters, districts, district and sub-district headquarters, location of mine safety stations and field offices, and headquarters of mine safety cars, safety and inspection divisions, health and safety service, Bureau of Mines.

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should be done, eventually they will adopt and maintain such measures. The nationwide nature of the health and safety work of the Bureau permits its representatives to become better acquainted with matters pertaining to health and safety in the mines of the United States than can representatives of any other agency, private, industrial, State, or Federal.

By the time the first annual report was made by the Director of the Bureau of Mines for the period July 1, 1910 to June 30, 1911, those in charge of the health and safety activities of the Bureau of Mines, for administrative purposes, had divided the United States into districts, with headquarters as follows: Pittsburgh, Pa.; Urbana, Ill.; Knoxville, Tenn.; McAlester, Okla.; Seattle, Wash.; and Birmingham, Ala.; and in 1911, additional stations were opened at Denver, Colo.; Pittsburgh, Kans.; Billings, Mont.; and Wilkes-Barre, Pa. All of these stations had certain more or less adjacent mining regions as their fields of activity.

The system of maintaining certain mining regions or States as districts with suitable headquarters at some mining city or town has been kept in effect continuously in connection with the work of the Bureau of Mines on health and safety in mining, and when the war period of 1941-45 came along there were eight districts with headquarters as follows (see fig. 1): District A, Pittsburgh, Pa.; District B, Wilkes-Barre, Pa.; District C, Mt. Hope, W. Va.; District D, Birmingham, Ala.; District E, Vincennes, Ind.; District F, Duluth, Minn.; District G, Dallas, Tex.; and District H, Salt Lake City, Utah. A number of subdistricts also were established, as follows: Albany, N. Y., in District B; Norton, Va., in District C; Jellico, Tenn., in District D; McAlester, Okla., in District G; and Denver, Colo., Phoenix, Ariz., Berkeley, Calif., and Seattle, Wash., in District H.

Hence, during all of the years between 1910 and the outbreak of the war in 1941 the health and safety work of the Bureau was administered through field districts, and, although some changes were made from time to time, the districting map of the Health and Safety Division (fig. 1.) shows that virtually all of the districts and district headquarters established in 1910 and early in 1911 were still in existence at the outbreak of the war and afforded an admirable framework for the administration of nationwide field activities of various kinds connected with the mining and allied industries. This was especially so because all of the heads of the districts were engineers with 10, 15, or more years of experience in the work of promoting health and safety in the mineral industries.

When the war-preparedness period of 1940-41 came, the Health and Safety Division was composed of two agencies - the Safeth Branch, with about 35 technically trained mining engineers and 35 safety instructors (chiefly nontechnical), with clerks and others making a total of about 90 persons; and a Health Branch, with chemists, physicists, clerks, and others totaling 17 persons. The full personnel quota of the Health and Safety Division was 107 persons when all positions were filled, and the total allotment of funds for the division was somewhat less than $400,000 a year.

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The Health and Safety Division grew very little in either funds or activities in the decade from 1930 to 1940, and this was reflected in relatively few changes in personnel: hence, when the war-emergency period arrived, both the Health and the Safety Branches of the Division had an experienced, well-informed, capable staff of administrative workers both in the field and in the laboratory. At least one-third of the approximately 75 engineers, safety instructors, chemists, and physicists in the Health and Safety Division at the beginning of 1940 had 15 or more years of experience in the health and safety work of the Bureau of Mines, and this was of inestimable value when the organization was expanded about fivefold in the period July 1, 1941, to June 30, 1942. The utilization of this force of competent, experienced men made possible the handling of this rapid increase in personnel (most of them in the field throughout the 48 States) with a minimum of confusion or delay and with a maximum of efficiency and coordination. The organization of the Health and Safety Division after the establishment of its five branches is shown in figure 2.

In performing the several types of more or less related work that was assigned to the Division, there were numerous possibilities for overlapping, duplication, and friction; however, the activities of the five branches were quickly correlated so as to insure freedom from duplication of effort and to attain maximum progress in forwarding the work in cooperation with the mining industry, the armed forces, and other affected agencies.

WARTIME ACTIVITIES OF THE FIVE BRANCHES

Safety Branch

When a state of national emergency was declared to exist and the preparedness-for-war program got underway, the Safety Branch of the Health and Safety Division had a staff of engineers and safety instructors well-trained in accident prevention in mines, mining and metallurgical plants, quarries, petroleum operations, and related establishments in or closely connected with the mineral industries. This organization had facilities strategically situated in the mineral-producing regions of the United States, which served as a nucleus for expanding to certain types of wartime activities with minimum time and effort and with maximum effectiveness. Many engineers and safety instructors were transferred to the Coal-Mine Inspection Branch when this agency was created, and the district and subdistrict offices administering the activities of the Health and Safety Division were almost entirely under the direction of Safety Branch engineers. The whole war program of the Health and Safety Division, therefore, was administered largely by Safety Branch personnel. The Explosives Control Branch, the Mineral Production Security Branch, and the Coal-Mine Inspection Branch were administered chiefly by members or former members of this Safety Branch who had 15 or more years of experience in safety work. In other words, the Safety Branch always was and still remains the keystone of the Bureau's work on safety and welfare.

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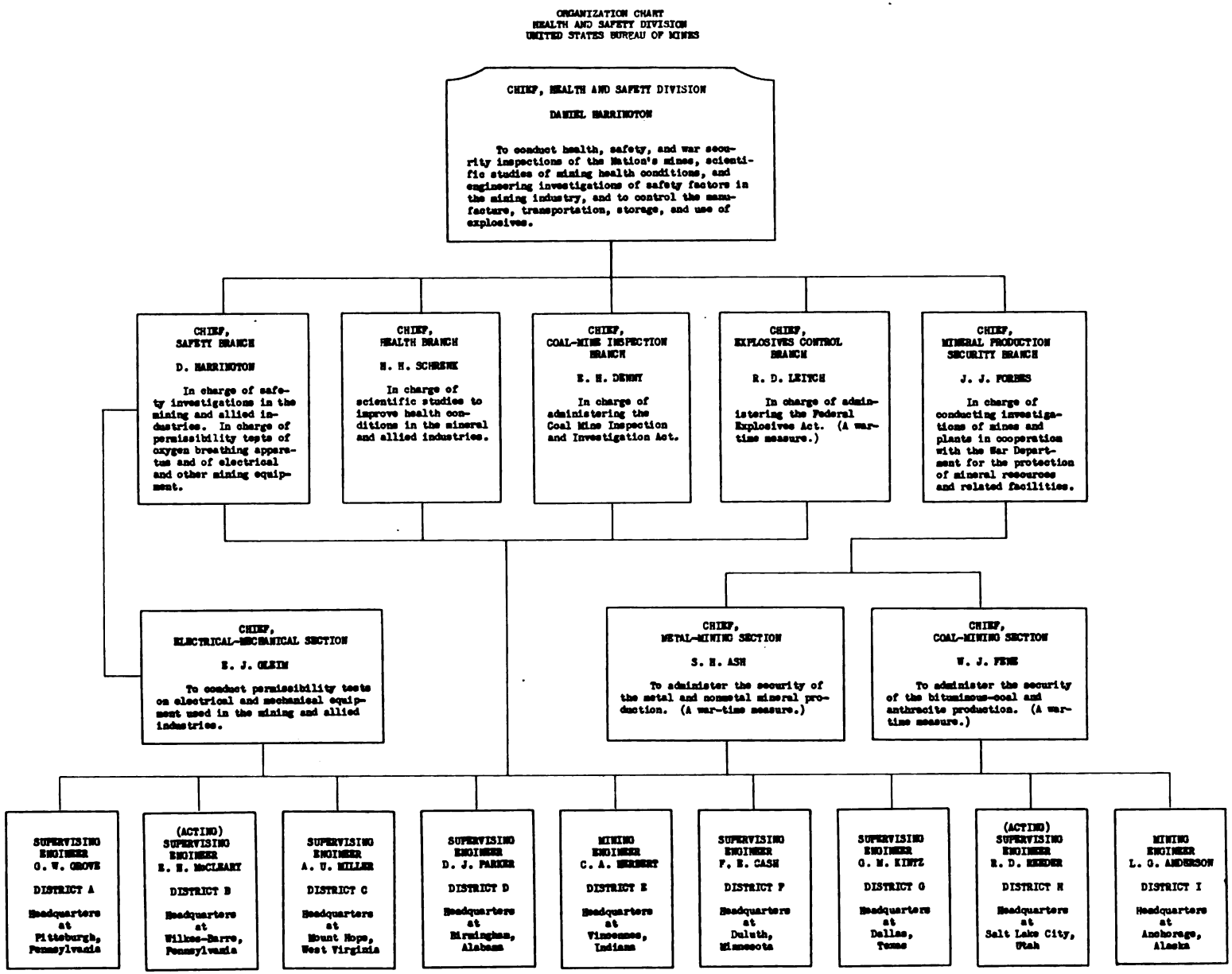
ORGANIZATION CHART
HEALTH AND SAFETY DIVISION
UNITED STATES BUREAU OF MINES
CHIEF, HEALTH AND SAFETY DIVISION
DANIEL HARRINGTON
To conduct health, safety, and war security inspections of the Nation's mines, scientific studies of mining health conditions, and engineering investigations of safety factors in the mining industry, and to control the manufacture, transportation, storage, and use of explosives.
CHIEF, SAFETY BRANCH
D. HARRINGTON
In charge of safety investigations in the mining and allied industries. In charge of permissibility tests of oxygen breathing apparatus and of electrical and other mining equipment.
CHIEF, HEALTH BRANCH
M. H. SCHRENK
In charge of scientific studies to improve health conditions in the mineral and allied industries.
CHIEF, COAL-MINE INSPECTION BRANCH
E. H. DENNY
In charge of administering the Coal Mine Inspection and Investigation Act.
CHIEF, EXPLOSIVES CONTROL BRANCH
R. D. LEITCH
In charge of administering the Federal Explosives Act. (A war-time measure.)
CHIEF, MINERAL PRODUCTION SECURITY BRANCH
J. J. FORBES
In charge of conducting investigations of mines and plants in cooperation with the War Department for the protection of mineral resources and related facilities.
CHIEF, ELECTRICAL-MECHANICAL SECTION
E. J. OLSIN
To conduct permissibility tests on electrical and mechanical equipment used in the mining and allied industries.
CHIEF, METAL-MINING SECTION
S. H. ASH
To administer the security of the metal and nonmetal mineral production. (A war-time measure.)
CHIEF, COAL-MINING SECTION
W. J. FENE
To administer the security of the bituminous-coal and anthracite production. (A war-time measure.)
SUPERVISING ENGINEER
C. W. GROVE
DISTRICT A
Headquarters at Pittsburgh, Pennsylvania
(ACTING) SUPERVISING ENGINEER
E. H. McCLEARY
DISTRICT B
Headquarters at Wilkes-Barre, Pennsylvania
SUPERVISING ENGINEER
A. U. MILLER
DISTRICT C
Headquarters at Mount Hope, West Virginia
SUPERVISING ENGINEER
D. J. PARKER
DISTRICT D
Headquarters at Birmingham, Alabama
MINING ENGINEER
C. A. HERBERT
DISTRICT E
Headquarters at Vincennes, Indiana
SUPERVISING ENGINEER
F. E. CASH
DISTRICT F
Headquarters at Duluth, Minnesota
SUPERVISING ENGINEER
G. M. KINTZ
DISTRICT G
Headquarters at Dallas, Texas
(ACTING) SUPERVISING ENGINEER
R. D. REEDER
DISTRICT H
Headquarters at Salt Lake City, Utah
MINING ENGINEER
L. G. ANDERSON
DISTRICT I
Headquarters at Anchorage, Alaska

Figure 2.

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First-Aid and Mine Rescue Training

In 1941 and early in 1942, the Health and Safety Division was expanding rapidly into definite war activities with the establishment of three new wartime agencies under its jurisdiction. This placed a considerable strain upon the administrative and engineering personnel of the Safety Branch. Many of the normal peacetime activities of the Branch were considered to be essential to the war effort, particularly training in first aid, mine rescue, and accident prevention, all of which aim at the conservation of manpower through the prevention of accidents or the mitigation of the effects of accidents. Accordingly, in spite of the curtailment of its force through assignment of many instructors and engineers to the war agencies, the Safety Branch made every effort to continue the instruction courses.

This effort was eminently successful during 1941 and 1942, and more than 170,000 persons in the mineral industries and approximately 6,000 outside these industries were trained in first aid, and 5,465 received training in mine rescue work. The results of first-aid training are difficult to evaluate; however, in the period July 1, 1941, to July 1, 1944, at least 150 lives were reported saved as a direct result of application of first aid. Probably several times that number (estimated at 200 lives a year) were saved but not reported. In addition, more than 1,250 Department of the Interior employees at Washington, D. C., and elsewhere were trained in first aid, and many groups associated with the war program, such as civilian defense workers, received similar training. Bureau of Mines-trained instructors were authorized to act as instructors in the Red Cross first-aid training program, and hundreds of persons were trained by this cooperative method.

The interest in first-aid training manifest in the early years of the war disappeared as the likelihood of disaster in this country from bombing or subversive activities lessened and gradually disappeared and restrictions of gasoline supply and travel accomodations tightened. The shortage of manpower and the longer working hours had an adverse effect upon the attitude of mine and plant employees toward attendance at training classes, and the rigid application of the Wage-Hour Act, requiring pay for attendance at safety meetings, including first-aid instruction, had a decidedly adverse effect upon first-aid training work, which is clearly shown in the following summary.

Number trained (by fiscal years)

Year	First aid	Mine rescue
1940.....	91,308	2,667
1941.....	83,883	3,311
1942.....	88,262	2,154
1943.....	43,454	2,649
1944.....	21,681	2,822
1945.....	15,195	2,983

The accident-prevention benefits formerly achieved by mass training in first aid have been replaced in coal mining, at least in part, by safety inspections, instructions in safe practices, and improved supervision,

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although the first-aid training of the prewar period should be reconstituted and even expanded in peacetime, as careful first-aid training is one of the most effective means of accident prevention available to the mining industry.

Mine rescue training includes instruction in the use of oxygen breathing apparatus and gas masks as well as procedures to follow in rescue and recovery operations following mine explosions and during mine fires. The importance of placing mines in condition for quickly resuming production of coal or ore is secondary to saving lives, but resumption of mining is important in keeping production at a high peak. Safety Branch personnel from July 1, 1941, to October 1, 1945, assisted in rescue and recovery operations at more than 174 mine explosions and fires and investigated a total of 233 fires and explosions. Detailed reports recommending means of preventing recurrences of similar fires and explosions were submitted. During the war more than 300 men were rescued following mine fires and explosions. The number saved as a direct result of Bureau of Mines training is not known definitely, but information as to methods of barricading and procedure to follow after explosions and during mine fires has been part of the instruction given in first aid and mine rescue training. This instruction has unquestionably saved the lives of scores of miners; saving lives during a war is especially significant, not only from the humanitarian viewpoint but also from that of providing maximum production of minerals and metals essential to the prosecution of the war, and it is of essentially the same importance (at least as to life and limb) in time of peace.

Training in wearing oxygen-breathing apparatus was not restricted to persons in the mineral industries. This type of apparatus, which may be worn in most irrespirable atmospheres, has an important place in war-products plants. The apparatus was demonstrated at several plants where gas masks might have become useless during fires of some materials.

One of the standard services of the Safety Branch is inspection of privately owned mine rescue stations and equipment. During the war, a large number of mining companies repaired defective equipment at the suggestion of Bureau representatives, and a number of company- and State-owned stations were put into operation.

Safety Instruction

The Safety Branch continued during the war to give instruction courses in safety and accident prevention to the personnel of coal and metal mines, petroleum refineries, quarries, and metallurgical plants. As manpower became less, this work was considered increasingly important by the mineral industry itself and other government agencies as a means for conserving manpower, and the effort increased as the war progressed.

From July 1, 1941, to October 1, 1945, supervisory officials and workers completed the following courses of instruction conducted by personnel of the Safety Branch:

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Accident prevention - coal	700
Safety instruction - coal	4,009
Accident prevention - metal.....	902
Petroleum gas	807
Explosives	36
	6,454

In addition to the above, more than 4,200 persons received worthwhile instruction but did not complete the courses.

A method that tends to keep men on the job by preventing injuries was developed. Safety-instruction courses were given to miners and mine officials in coal mines, and a similar course of instruction for metal-mine supervisors was initiated in 1942 and was expanded rapidly.

Petroleum Courses

Explosions and fires constitute daily hazards to life and to productivity in the petroleum industry, and safety courses and lectures were developed to give instruction in the safe handling of petroleum and its gases for officials and selected persons in the petroleum industry. As an outgrowth of these courses, the Bureau of Mines developed a shorter course on safe handling of petroleum gases and products. This course was given at classes sponsored by the University of Texas under authority of the United States Office of Education cooperating with the Committee for Conservation of Manpower in War Industries. It was also given to the supervisory staff of the Eighth Service Command and to classes sponsored by the Southern Methodist University. A companion course was given at Texas A. and M. College, at the University of Oklahoma, and to the Air Corps at Oklahoma City, Okla. The course was also given at the United States Navy Training Base at Norman, Okla.

The persons receiving class instruction were key employees, and as a result of the knowledge of hazards existing in petroleum plants many changes and improvements were made that undoubtedly prevented loss of manpower and petroleum products.

A series of lectures was develcped for general meetings. The topics include "Magic of fire," and "What is fire and what causes an explosion?" Many oil companies considered these lectures and demonstrations so valuable that employees were paid for attending the meetings.

Demonstrations of Coal-Mine Hazards

Demonstrations of coal-dust explosibility and the dangers of electric arcs and sparks in coal dust and explosive gases were given to numerous audiences composed of persons connected with the mineral industries. By demonstrating these hazards, the means of preventing mine explosions were emphasized. It is estimated that several thousand persons attended the meetings.

Sound motion pictures were an effective means of teaching safety to persons in the mineral industries. It is estimated that approximately 16,000 persons a year saw these safety-education pictures during the war years.

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Safety Branch personnel gave addresses on safety topics at 617 safety meetings during the war. An estimated 213,233 persons attended the meetings and demonstrations. The net result was an increase in safety consciousness that extended not only to daily work but also to daily living.

Special Investigations

Many calls for assistance were made during the war, both in the mineral industry and outside the normal scope of the Branch. Approximately 300 such special investigations were made. These included explosions from a wide variety of materials and numerous causes of initiations, asphyxiations, fires and explosions from gases and fumes, truck and plane disasters involving fires or explosions, contaminations of air or water detrimental to the health of workers, and ventilation surveys in mines and war plants. All investigations were covered by written reports, including recommendations to prevent a recurrence of the accident or hazardous condition.

The Safety Branch cooperated with the Chemical Warfare Service as well as other agencies of the armed forces in numerous studies and investigations. These included investigations of the problems relating to extinguishment of incendiary bombs, and over 100 products and devices for extinguishment were tested and reported upon, including storage of incendiary material, and studies on magnesium dusts and other flammable powders. Personnel of the Safety Branch explained and demonstrated incendiary-bomb control methods to approximately 300 persons selected from various points in the Eastern States to receive training in Civilian Defense Work. Extended study was made of the formation of phosgene from carbon tetrachloride when used to extinguish burning magnesium incendiary bombs.

Cooperation With Other Government Agencies

When the war began, the Safety Branch had in its personnel many men qualified as experts in their knowledge of the materials and conditions that cause disasters, whether war-born or resulting from new or expanded uses of little-known or new materials in industry. As difficult problems arose in the various war agencies, the Safety Branch was called upon frequently to furnish information or personnel to study, test, report upon, and make recommendations as to these problems. Some of the agencies for which special war work was carried on were the War Department, State Department, Ordnance Department, Internal Security Division, Office of the Surgeon General, Navy Department, War Production Board, War Manpower Commission, United States Coast Guard, Defense Plant Corporation, Solid Fuels Administration, and Foreign Economics Administration. Some of the activities in which Safety Branch personnel were engaged for the above agencies were fire and explosion prevention in ordnance and munition plants, die-casting plants, oil-storage tanks, storage of kapok, and defense plants; investigations into the toxicity of substitutes for freon in Aerosol bombs; explosive properties of aluminum powder; use of wetting agents; giving advice on the best methods for reopening the wrecked coal mines of Europe; and conducting a school on dust-explosion hazards.

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Rescue Service Program of the Office of Civilian Defense

War from the air, accompanied by widespread bombing of civilians, brings with it the problem of rescuing casualties from the debris of demolished buildings. In every bombing incident where casualties are trapped, rescue squads must be dispatched to release them.

There is a striking parallel between the type of rescue work in connection with peacetime disasters, such as those caused by floods, explosions, earthquakes, fires, and hurricanes, and those caused by war. It has been found that any work done in connection with training civilian personnel in rescue work can be a lasting contribution to saving life at the time of a disaster from any cause. Training rescue squads, therefore, was thought of in terms of a long-range and continuous program. Training was similar in many respects to training in mine rescue.

The Rescue Service was one of the Emergency Services of the United States Citizens Defense Corps, which was established by administrative order of the Director of the Office of Civilian Defense, Washington, D. C. The Citizens Defense Corps was composed of patriotic persons who had undergone rigorous training in special fields in order to serve their communities and the nation in Civilian Defense.

The matter of organizing a new Rescue Service and developing an up-to-date action program was urgently necessary. On November 11, 1942, Dr. R. R. Sayers, director of the Bureau of Mines, was asked by James M. Landis, director of the Office of Civilian Defense, to undertake this important responsibility.

On recommendation of Dr. R. R. Sayers, S. H. Ash, chief of the Metal-Mining Section, Mineral Production Security Branch, Bureau of Mines, was commissioned in the rank of Lieutenant Colonel, U. S. Public Health Service (R), and designated chief of the Rescue Section of the Medical Division, U. S. Office of Civilian Defense, on April 7, 1943.

Other mining engineers with rescue experience were commissioned in the U. S. Public Health Service and were assigned as rescue officers to the Civilian Defense Regions in the target areas to assist States and local communities in organizing and training the Rescue Service.

Functions of the Rescue Service

Conferences with Dr. R. R. Sayers, D. Harrington, and J. J. Forbes, of the United States Bureau of Mines, resulted in the development of a training program that made available certain Bureau of Mines facilities and personnel for use in developing and carrying out an action program. A Technical Manual for the Rescue Service was prepared.

In order to develop leadership and establish uniformity in procedure in the Rescue Service throughout the United States, two Pilot Rescue Schools were sponsored by the Office of Civilian Defense in cooperation with the Bureau of Mines. The Pittsburgh School was held at the Bureau of Mines

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Experiment Station, Pittsburgh, Pa., October 4-14, 1943, inclusive. Seventy-four students from 16 States and the Dominion of Canada enrolled at the school.

The Bureau of Mines contributed valuable equipment for use and also supplied the lecture rooms and training facilities as well as special equipment at the Bureau of Mines Experiment Station.

The Berkeley School was held at the College of Mines Building, University of California, Berkeley, Calif., November 8-18, 1943, inclusive. Total enrollment was 66.

After the completion of the pilot schools, State and regional schools were held in various parts of the country, particularly in large cities. These were headed by graduates of the pilot schools. The Bureau of Mines had a part in all of these schools, furnishing equipment and personnel to lecture on courses at the school and to train the students in first aid and use of respiratory protective equipment.

The functions of the Office of Civilian Defense were terminated when there was assurance that continental United States would not be bombed or otherwise invaded, and inasmuch as the original objectives of the Rescue Service on the national level were completed but could be continued if and when the occasion requires, the Bureau of Mines employees on leave for assignment to the Office of Civilian Defense were inactivated and returned to the Bureau.

The Rescue Service Manual has been widely distributed and favorably received.

It is safe to say that the Rescue Service would not have gotten beyond the paper stage nationally without the cooperation, assistance, and collaboration of the Bureau of Mines.

War Activities of the Electrical-Mechanical Section

The Electrical-Mechanical Section of the Safety Branch contributed directly as well as indirectly the Nation's preparation for and prosecution of World War II. The direct assistance was in connection with protection of life and property on board Naval vessels, in munitions plants, at air fields, and in the planes themselves. The indirect assistance was largely in connection with increased production of coal in foreign countries through American-built mining machinery approved by the Bureau of Mines and supplied under lend-lease.

In 1938, the Navy Department proposed a general application of explosion-proof electrical equipment to aircraft carriers and other vessels carrying highly volatile aviation gasoline, and because of the Bureau's long experience in testing mine electrical equipment its aid was solicited in the investigation of electrical equipment developed for Naval use. More than 100 electrical items were tested and reported upon. Figures 3, 4, 5, and 6 show special apparatus developed for these tests.

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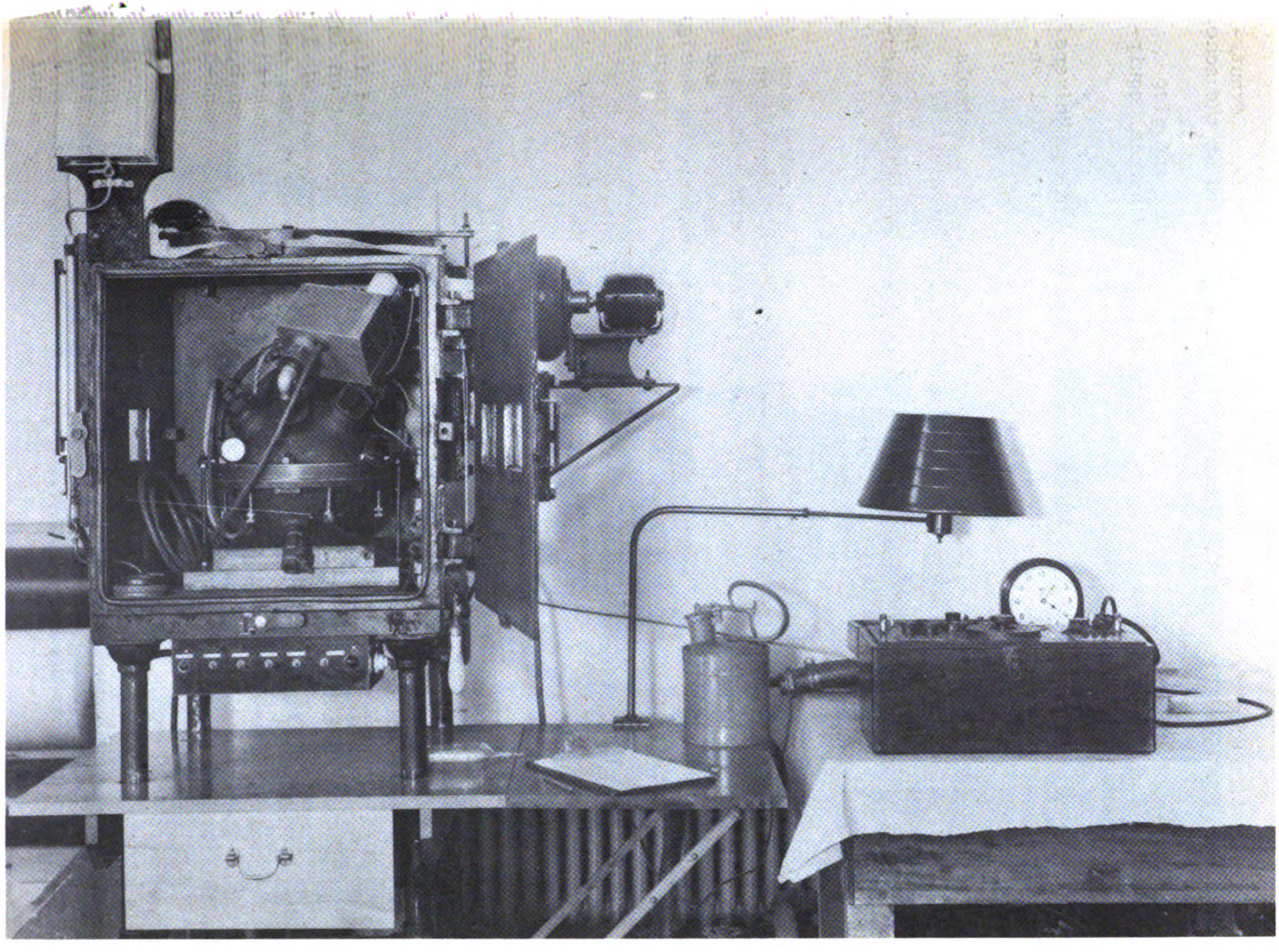

Figure 3. - Gallery 18 with "bomb" and auxiliary apparatus used in comparing explosion characteristics of aviation gasolines, "dope" solvents, etc.

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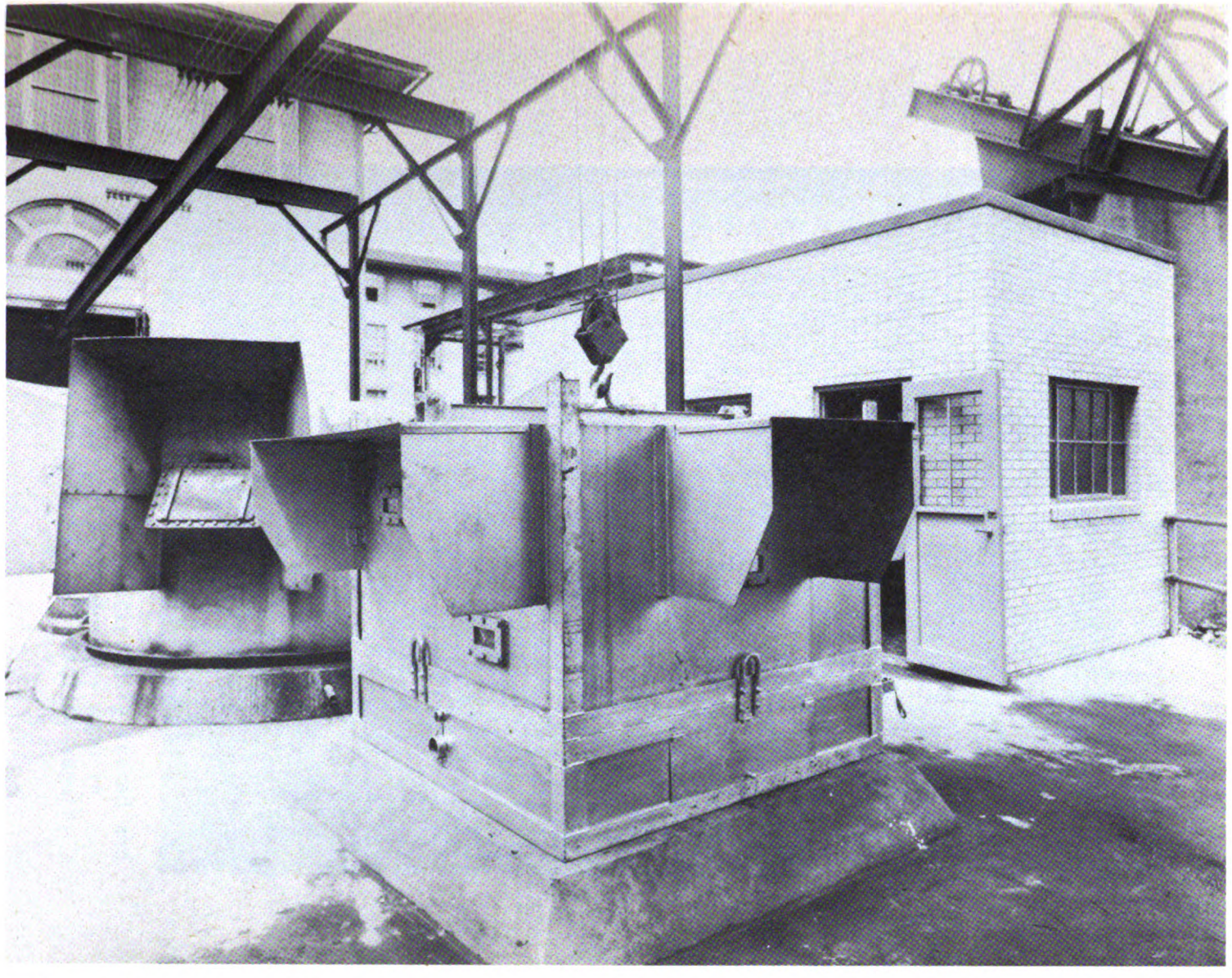

Figure 4. - Gallery 17 used in explosion-testing of motors, controllers, and other electrical equipment designed for use in hazardous atmospheres on aircraft carriers, gasoline lighters, etc. (Control house in right background.)

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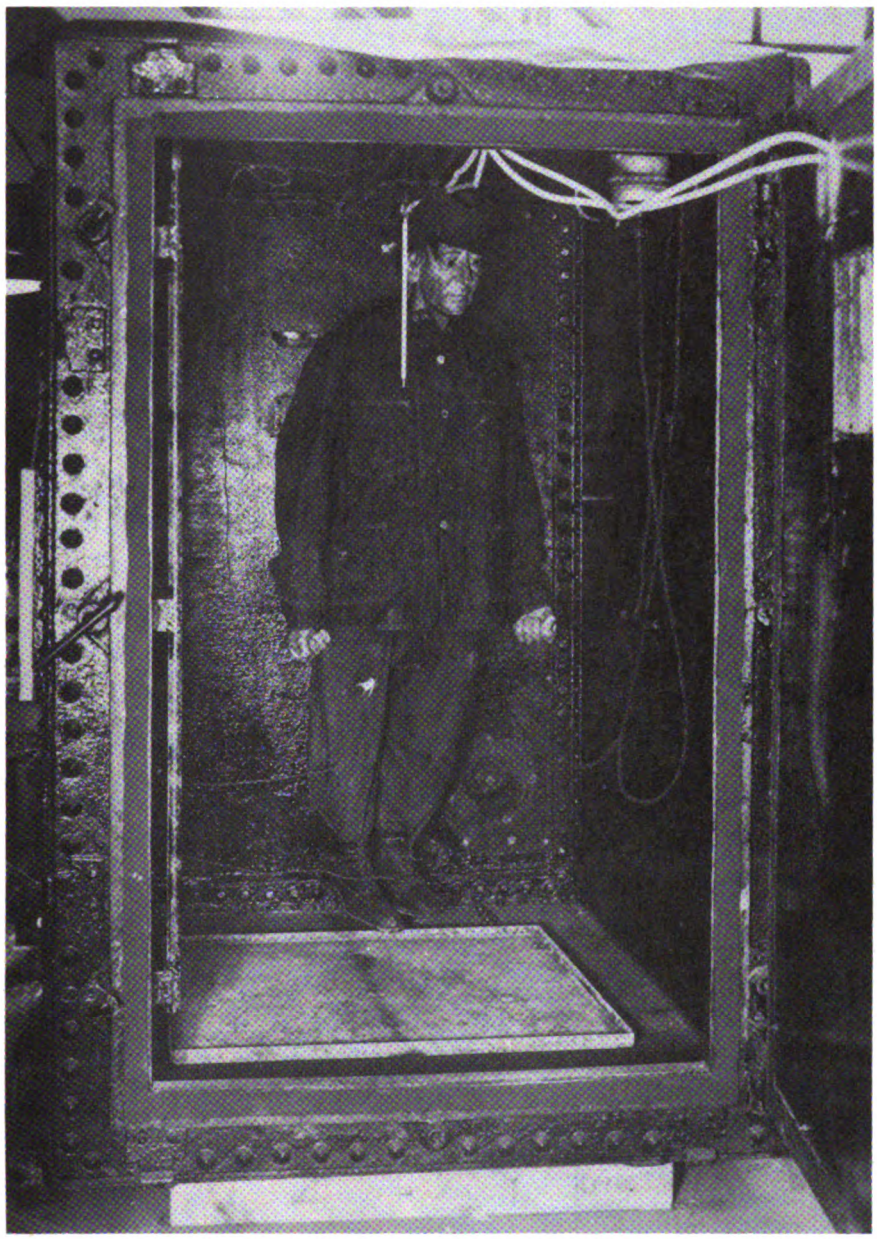

Figure 5. - Gallery 14, with electrically heated and mechanically operated dummy used in study of diffusion of gasoline vapors.

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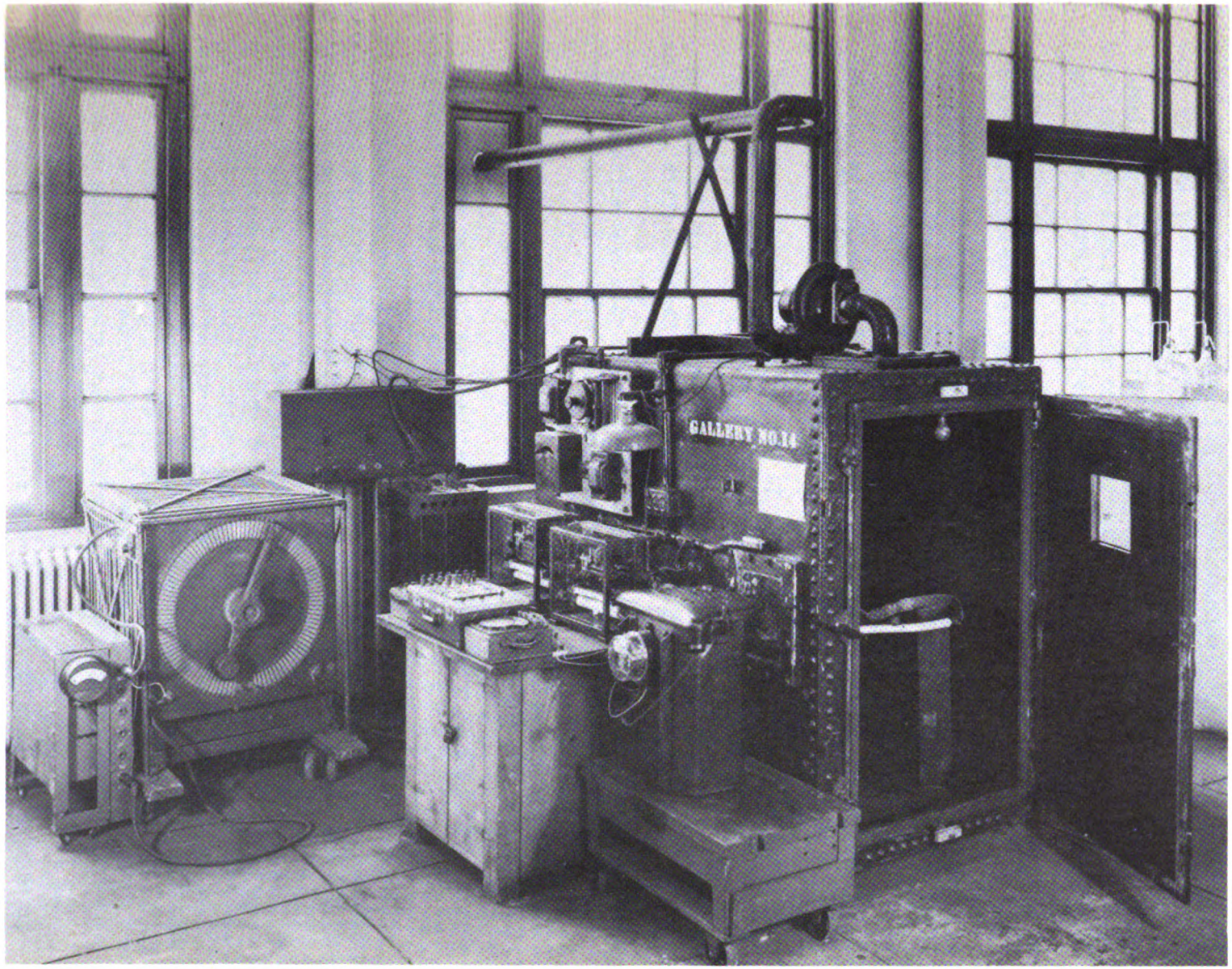

Figure 6. - Gallery 14, with electrical measuring and control apparatus used in study of toxic gases given off by overheated insulation of electric cables.

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In addition to the foregoing, the Bureau of Ships, Navy Department, has from time to time asked the Section for recommendations and assistance in solving special problems of safety. Some of these are as follows:

Because of the use of airplane "dope," dope solvents, and various grades of gasoline and liquid fuels on ships, information was desired on their relative explosion characteristics.

The possibility of open elevator brakes becoming hot enough to ignite explosive atmospheres was another question to be answered.

British experimenters found it possible to ignite explosive atmospheres by sparks resulting from sharp blows on rusty steel or iron that had been seated with aluminum paint, and investigations were requested.

The suitability of plastic materials as a substitute for glass in globes for explosion-proof portable lamps was investigated.

Information on the possibility of igniting explosive atmospheres by the operation of a tool known as a "velocity power cable press" was required.

Combustibility of liquids spilled or escaping through leaky pipes and containers, diffusing and mixing with air was investigated.

Information was sought concerning the toxicity of gases and vapors evolved from insulating materials when electric cables become overloaded.

The Bureau's recommendations were sought regarding the construction of trucks that could be operated safely in munitions plants.

A study was made of the ignitability of explosive vapors by abrasive sparks from various combinations of metals.

With the entrance of the United States into the war, many coal-cutting and loading machines were shipped to foreign countries under the lend-lease program. The United States Treasury Department required that such equipment have the approval of the Bureau of Mines. Many of the machines had to be specially designed to meet the conditions peculiar to foreign mines. This meant a departure from the usual Bureau of Mines procedure in approving equipment, as well as additional inspections and tests, as the available standard designs were not suited to foreign conditions. Under this program the following machines were investigated: 2 shortwall mining machines, 2 mining-machine trucks, 1 shaker conveyor, 3 chain conveyors, 1 elevating conveyor, 1 loading machine, 1 battery-operated "shuttle car," and 1 post-type coal drill. American methods and machinery undoubtedly have aided in the production of coal from the mines of our allies.

The Safety Branch gave excellent service not only to the Health and Safety Division, the mineral industries, and numerous war agencies in its expanded activities in health and safety work, but, whenever called upon, it has done yeoman work in servicing the entire war effort.

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Health Branch

At the beginning of the war, the Health Branch had at its disposal extensive data on the occurrence, determination, toxicity and physiological effects, and control of atmospheric contaminants, gases, vapors, and dusts, and on many related subjects. There was on hand a variety of equipment and apparatus for making studies relative to the atmospheric environment. In addition, personnel with the "know how" was available to utilize this information and equipment and to make field and other studies to apply the equipment and knowledge of toxic and explosive air contaminants.

The work of the Health Branch during the war may be classified as follows: (1) Special war problems, (2) investigations "to improve hygienic conditions in the mineral industries in order to maintain health and increase efficiency and morale, thus conserving the productivity of American workers, a resource indispensable to national defense" and, it might be added, to winning the war, and (3) dissemination of information on matters pertaining to the foregoing.

Special War Problems

The Navy Department requested the assistance of the Health Branch of the Bureau of Mines on several occasions. Probably the most interesting and important problem that was studied for the Navy Department related to the hazards from carbon monoxide on LST ships (tank landing ship). This problem required the utilization of the Bureau's experience in ventilation, determination of toxic gases and knowledge of their physiological effects and of the production of toxic gases by internal-combustion engines.

The basic problem was to design a system of ventilation for the ship's hold so that harmful concentrations of carbon monoxide would not accumulate during the prolonged warming-up of the engines of tanks and other vehicles immediately prior to landing.

After numerous conferences in Washington and elsewhere, plans were formulated to conduct tests on single tanks in small chambers at the Aberdeen Proving Grounds, Aberdeen, Md. (fig. 7), and later to make tests in a full-scale replica or "mock-up" of the ship's hold at Fort Knox, Ky. (figures 8 and 9). General arrangements were made for the Bureau of Mines to assume full direction of test procedures, including gas sampling and analysis, and air measurements.

At the conclusion of the tests, the head of the Test and Research Section of the Proving Grounds said it was the fastest test project, for its size, ever put through the Proving Grounds, and that it was completed at just about the time when it had been thought it would be getting under way.

The tests were concluded May 29, 1942, and the chief of the Bureau of Ships had the following to say in a letter to the Director:

> The invaluable assistance of these capable men and the complete cooperation of the Bureau of Mines aided greatly in the rapid and

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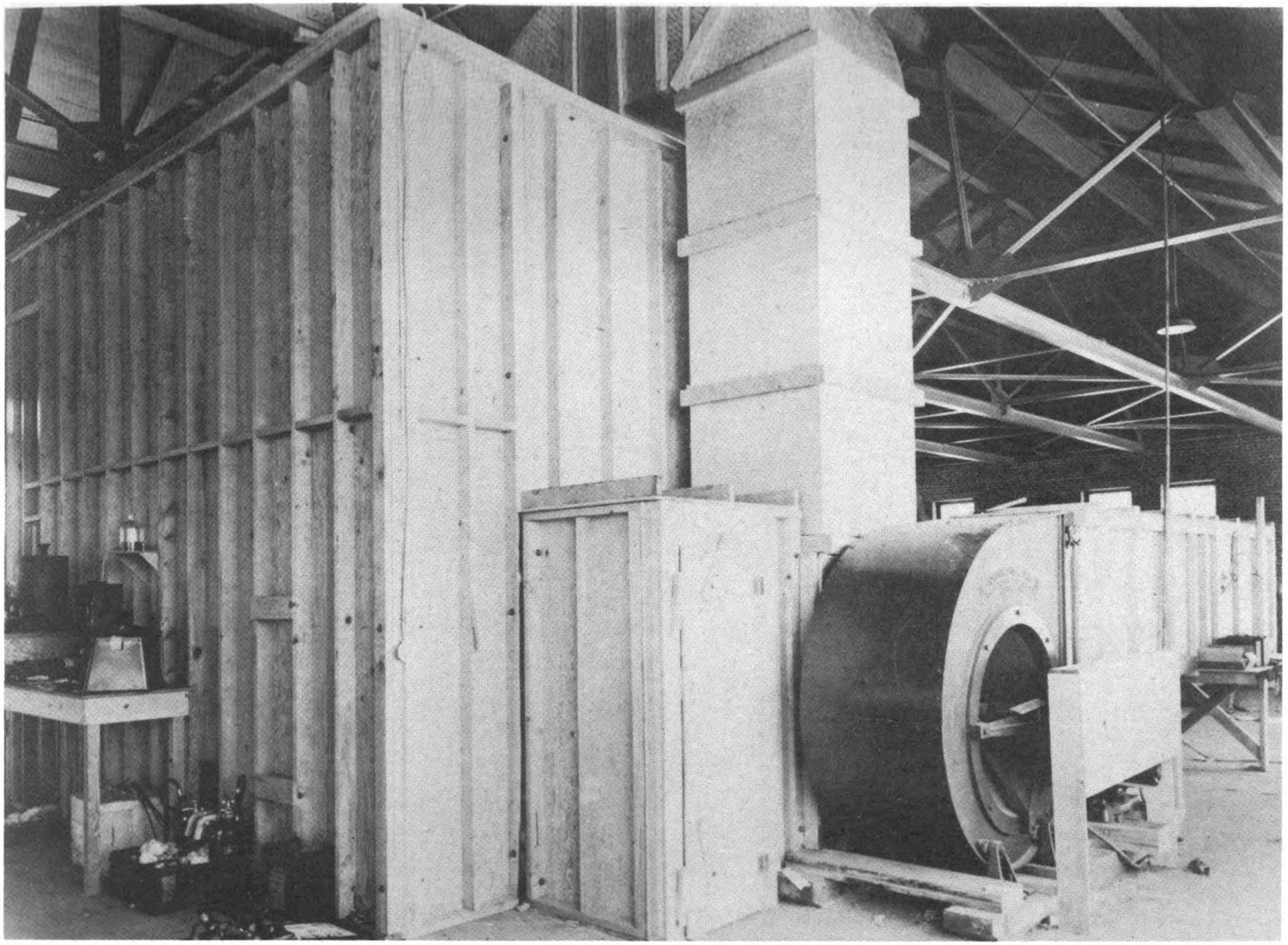

Figure 7. - Front three-quarter view showing air lock blower and exhaust ducts of test chamber.

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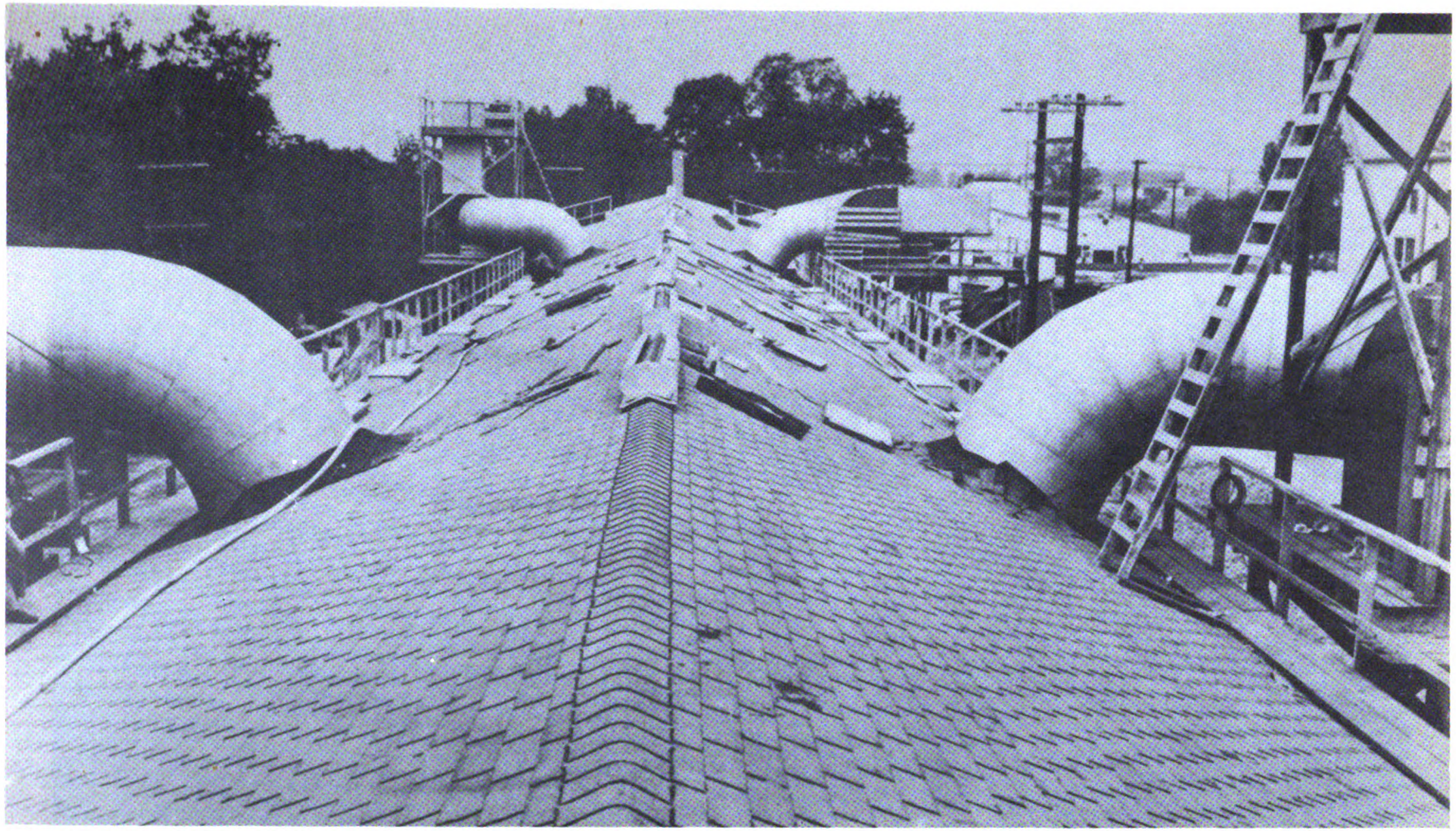

Figure 8. - General view of mock-up roof toward the prow showing 4 of 6 air exhaust ducts.

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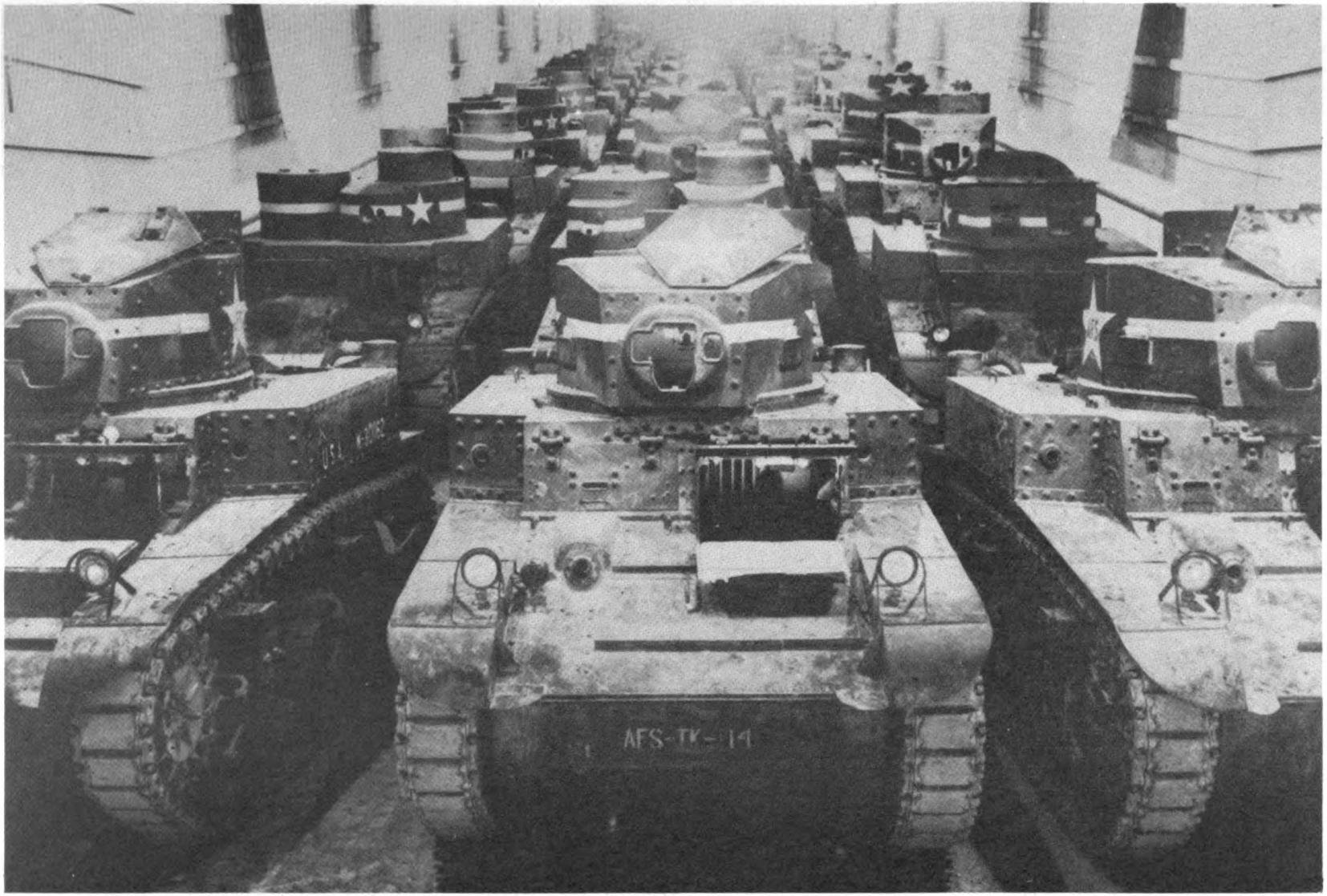

Figure 9. - View of bay from a point just above incline leading to bow opening, with 39 light tanks in position.

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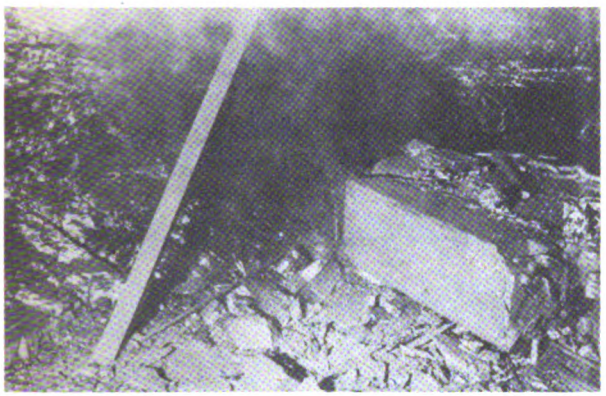


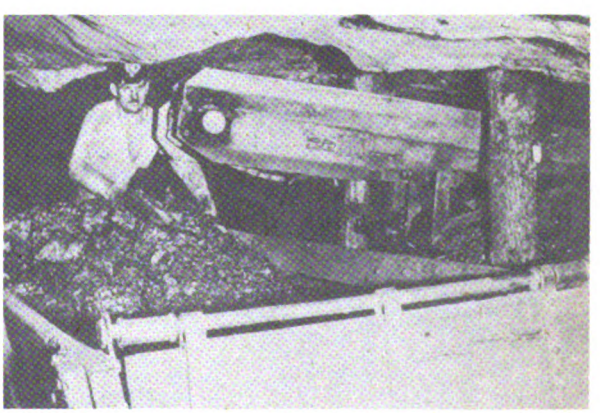
Cutting of dry coal.

Cutting of wetted coal.

Hand loading of dry coal.

Hand loading of wetted coal.

Conveyor loading of dry coal.



Conveyor loading of wetted coal.

Figure 10. - Use of water to prevent dissemination of dust.

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satisfactory solution of the problem of ventilating the vessels. The Chief of the Bureau of Ships, therefore, wishes to thank you and your personnel for the excellent assistance rendered.

Among the numerous important investigations, tests, and studies made by the Health Branch were the following:

Investigation of pipeline explosion in Hull 394 at Newport News

Investigation of the loading of packaged gasoline at New York Port of Embarkation

Application of carbon tetrachloride-type fire-extinguisher liquid to burning magnesium chips

Determination of carbon monoxide hazard on the hangar deck of an aircraft carrier

Tests of gas-indicating instruments for Bureau of Ships, Navy Department

Determination of toxic gases produced by thermal decomposition of the insulation of electric cables by current overload

Study of toxic gases produced by burning or thermal decomposition of molded and laminated thermosetting plastic materials

Investigations to increase production by improving working environment (figure 10)

Surveys and inspections in military establishments and industrial plants

These projects were concluded rapidly and satisfactorily, and many commendatory letters were received from the agencies concerned.

In addition to work on these specific projects, the laboratories of the Health Branch at Pittsburgh, Pa., were kept busy by various agencies in addition to a greatly increased volume of normal routine work. Prior to the war, the Gas Analysis Laboratory averaged between 1,500 and 2,000 samples annually. The number of samples analyzed in 1942 was 10,189; in 1943, 13,567; in 1944, 16,950; and in 1945 it exceeded 17,000.

X-ray, Spectrographic, and Petrographic Laboratories

Numerous samples of dust and source material from coal and metal mines have been analyzed, particularly for "free silica" or quartz, as this constituent is thought to be the most important from the standpoint of dust disease. In addition to these samples, a wide variety of samples from many sources have been analyzed. They include samples collected in connection with studies relating to metallurgy, explosives, hydrogenation, fertilizer, fuels, constitution of coal, and samples submitted by the Medical Research Laboratory of the armed force and various State organizations. The samples

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included such materials as alloys, carbon black, incendiary bombs, catalysts, metal powders, fume and smoke producers, boiler scale, welding fumes, metal grit, and slag, as well as many others.

Approval of Respiratory Protective Devices

The main contribution of the Respirator Laboratory to the prosecution of the war was its work on testing and approving respiratory protective devices, as a result of which users of these devices were able to choose from a list of approved devices of tested quality those best suited to their needs.

At the start of the war the Bureau of Mines had provisions for testing and approving all types of respiratory protective devices with the exception of chemical-cartridge respirators. With the increased use of spray painting, especially with lead-base paints, in the construction of ships there was a demand that the Bureau establish a schedule for approval testing of chemical-cartridge respirators equipped with mechanical filters to remove both the organic vapors and the particulate lead from the air inspired by the workers.

Tests were made in the Respirator Laboratory on representative chemical-cartridge respirators to determine the protection they would afford against organic vapors. From these data and from thorough consideration of the characteristics which chemical-cartridge respirators should have, Schedule 23, entitled "Procedure for Testing Nonemergency Gas Respirators (Chemical-Cartridge Respirators) for Permissibility," was prepared and issued November 13, 1944.

Hundreds of thousands of Bureau of Mines-approved respiratory protective devices are in use in virtually every industry in this country. They are widely used in fire departments, the mining industry, manufacture of military equipment and explosives, synthetic-rubber industry, petroleum industry, and to a certain extent by the nation's armed forces.

The services and equipment of the Health Branch made a very definite and essential contribution to the successful prosecution of the war. There were almost daily requests for information as to suitable procedures, devices, and equipment to safeguard workers in processing plants against air contaminants etc., and a considerable percentage of the requests came from the armed forces or from plants working more or less directly for or with the armed forces. The specialized technical knowledge of the personnel of the Health Branch as to matters pertaining to air contaminants is not exceeded by that of any other agency private or governmental in the United States and it was of enormous value to the successful prosecution of the recent war.

Coal-mine Inspection Branch

The Federal Coal-Mine Inspections and Investigations Act was signed by the President of the United States May 7, 1941, and in June 1941 Congress appropriated $729,000 to the Bureau of Mines to administer the act during the fiscal year July 1941- June 1942. This sum, earmarked for use in coal-mining health and safety work, was virtually twice as much as had ever been given the Health and Safety Division for work in all phases of mining,

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including coal. Recognizing that the proposed mine-inspection work fitted into the work of the Health and Safety Division, the Director of the Bureau of Mines assigned the duty of planning its organization and placing its provisions into effect to the chief of the Health and Safety Division, who had been engaged in Bureau of Mines health and safety work more than 25 years. Some personnel of the Department of the Interior well versed in formulating new organizations cooperated in the preliminary work of organizing and obtaining finances for the new activity.

The original budget divided the funds into 11 units, chief of which was the Field-inspection Service in the Coal-Mine Inspection Branch, to which Congress allotted $498,935 of the $729,000 for the first year's operation. The other units were as follows: Investigations on Electricity and Explosives in Coal Mines, placed in the Coal-Mine Inspection Branch, with $44,100; Occupational Disease Investigation, placed in the Health Branch, Health and Safety Division, Pittsburgh, with an allotment of $24,650; Coal-Mine Inspection Branch (administrative office), headquarters Washington, D. C., with an allotment of $24,110; Information Unit, Washington, D. C., with an allotment of $26,885; Gas and Dust Laboratory placed in the Health Branch, Health and Safety Division, Pittsburgh, with an allotment of $29,445; Testing of Electrical Machinery, placed in the Safety Branch, Health and Safety Division, Pittsburgh, with an allotment of $8,420; coal-analysis work placed in the Coal-Analysis Section, Fuels and Explosives Division, Pittsburgh, with an allotment of $12,765; Coal-Mine Accident Statistics, in the Accident Analysis Branch, Economics and Statistics Division, Washington, D. C., with an allotment of $20,000; additional work in the Administrative Division, Washington, D. C., $14,630; and printing, binding, etc., $25,000.

The principal unit of the Federal Coal-Mine Inspections and Investigations Act was established as a new branch in the Health and Safety Division and was designated the Coal-Mine Inspection Branch, with an experienced engineer of the Safety Branch in charge as chief engineer and with experienced engineers of the Safety Branch assisting in the work in all of the districts in which coal mines are operated. Hence, the entire administrative set-up of the Coal-Mine Inspection Branch was taken from the experienced engineers of the Safety Branch, and this set-up remained essentially intact during the entire war.

Organization and Training

The original set-up for the Coal-Mine Inspection Branch permitted the employment of 107 inspectors and 10 engineers until July 1, 1944, when Congress authorized 25 more inspectors, with an additional 25 inspectors beginning July 1, 1945, bringing the total number of inspectors to 157. This number made it possible to inspect coal mines employing 25 or more men and a relatively few smaller mines. However, it was impossible to inspect most of the small mines with the force of inspectors and funds authorized by the Congress, and it was feasible to inspect the larger mines only once or, at best, twice a year under the careful procedure that was placed in effect.

Although the new Coal-Mine Inspections and Investigations Act was the result of long-range peacetime influences, it did not become a law until well

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along in the period of active preparation for National defense, and the work of the new Coal-Mine Inspection Branch had scarcely proceeded beyond the preliminary stage of organization at the time war was declared after Pearl Harbor; hence, it was involved immediately in the problems presented by the war program virtually as much as the two branches organized later purely as war measures.

The act specifies that any person selected as coal-mine inspector shall have "the basic qualifications of at least 5 years' practical experience in mining coal and is recognized by the United States Bureau of Mines as having training or experience of a practical mining engineer in those essentials necessary for competent coal-mine inspection." All grades of inspectors were chosen under the Civil Service procedure after more than 2,000 candidates took the Civil Service examinations. In appointing inspectors, utmost care was taken to select those qualified by experience in coal mining and in good physical condition; the latter qualification is very important, because mine inspectors who do a good job must have endurance far beyond that required for most other occupations, not only for routine inspection work but also for special duties required at mine explosions or mine fires or in making emergency investigations.

Special training was given to the newly appointed inspectors at the Central Experiment Station of the Bureau of Mines in Pittsburgh. This training included intensive instruction in the fundamentals of mine safety as embodied in the correlated information assembled by the Bureau of Mines through experiments, observation, and experience since 1910. Each instruction class comprised approximately 40 inspectors and engineers; lectures and demonstrations were given by experienced instructors, most of whom had 15 to 25 years experience in Bureau of Mines health and safety work. The instruction covered virtually every phase of coal-mining accident prevention taught by the Bureau.

The Coal-Mine Inspections and Investigations Act requires that reports of the mine inspections made under the act be publicized. Most of the newly appointed inspectors were not technically trained, and very few were particularly well educated or proficient in writing technical reports; they were carefully instructed how to make efficient mine inspections and to write accurate technical reports of them. The reports must be written with utmost care and accuracy, as most of the recommendations frequently, in fact almost invariably, embody controversial matters.

The newly appointed mine inspectors were experienced in the daily scrutiny of mine conditions, practices, and apparatus in their relation to safe and efficient coal-mine operation. Some of them had been underground operating officials and were familiar with requirements for daily compliance with State mine-safety laws or orders and company safety rules as well as for the efficient production of coal. Other inspectors had worked as engineers and were required to be familiar with mine operating conditions and procedures as well as with mine lay-outs and with the selection, installation, and operation of equipment. The requisite experience required for appointment as coal-mine inspector, when supplemented with the intensive training given by the Bureau of Mines, plus the careful supervision of their work, particularly their reports, made these inspectors more than ordinarily well-qualified for the

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positions they occupied; and with the training that accrues through experience, the coal mine inspection force of the United States Bureau of Mines gradually became an effective unit, especially when the reports were given careful and constant supervision.

The rapid progress in mechanizing coal mines had introduced numerous new hazards, particularly in connection with the use of electricity and explosives. Virtually all major coal-mine explosions that occurred during the past two or more decades were initiated either by electricity or explosives. The allotments for the Coal-Mine Inspection Branch provided for the employment of 5 mining-electrical engineers and 5 mining-explosives engineers to make safety investigations in the application of electricity and explosives in coal mining and to aid and advise the mine-inspection personnel in problems relating thereto. These men engaged almost continuously in making investigations and inspections in connection with electricity and explosives in coal mining and became experts on these subjects.

The act authorized the Bureau of Mines to make annual or necessary inspections and investigations in coal mines for the purpose of obtaining information relating to health and safety, the causes of accidents involving bodily injury or loss of life, and the causes of occupational diseases.

Although the act gave authority to enter mines, make inspections, and compile and issue reports on individual mining properties, it did not confer regulatory or police powers. The functions of the Coal-Mine Inspection Branch were almost wholly investigative, recommendatory, and educational, and this situation continued through the war. This necessitated preparation of many technical reports and editing and correlating the reports, as well as other work relating to the prevention of accidents. Following the war, the act continued in full force and effect, and the Coal-Mine Inspection Branch is now considered a permanent Branch of the Health and Safety Division.

The first group of approximately 50 inspectors and engineers reported for training November 17, 1941; upon completion of their training they were assigned headquarters in the various coal-mining fields of the United States and Alaska under the supervision of the supervising engineers at the 8 district offices and the 8 subdistrict offices of the Health and Safety Division.

Before inspections of coal mines could begin, it was necessary to formulate safety standards to guide the inspectors in making their recommendations and to correlate and systematize their work. A set of standards comprising some 600 provisions was prepared, to provide uniform, consistent methods and procedures and yet allow much latitude for modification under exceptional conditions.

The coal-mine inspection standards have been published as an information circular, and, in addition to their use by Federal coal-mine inspectors, they are much in demand by State inspectors, company safety engineers, and others interested in up-to-date safety procedures with especial reference to coal mining. Separate standards have been issued for bituminous-coal and anthracite mines, and both bituminous-coal and anthracite mine standards are revised from time to time to take into account provisions that have been found

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defective because of changes in mining practice or inability to obtain specific types of equipment. Over 30,000 sets have been distributed to the coal-mining public. During the war, the provisions of the standards as well as the inspection reports based on them were entirely recommendatory, with no compulsory provision except that of entry into mines and publication of reports.

Field Inspection Work

Inspection of a mine may take as little as one or two days or as much as several weeks, depending on the size of the property. Inspectors were required to visit every working place underground, as well as airways, manways, all entrances to abandoned workings, and all other places where men are required to work or travel and, in addition, carefully inspect the surface plant.

Air samples were collected and measurements made to determine the quality and quantity of the air at faces of working places, the returns from splits, and the main returns from the mine. Enough dust samples were collected to determine the need for rock dusting or the extent to which the mine was protected by rock dust if it was used. Observations were made concerning conditions and practices with respect to timbering, blasting, electricity, machinery, drainage, haulage, and other features affecting health or safety. The accident records of the mine, if obtainable, were studied to supplement the information obtained from inspection of the mine.

As soon as feasible after inspection was completed, the inspector was required to post a preliminary report at the mine in a place where it would be accessible to the mine employees as well as to the mine operator. The preliminary report briefly outlined safety conditions at the mine and called attention to hazards that should be corrected immediately.

After the preliminary report had been posted, the inspector prepared a final report that was virtually a technical safety engineering report of the mine and made specific recommendations for correcting conditions and practices that appeared likely to cause disasters or other accidents. This report was made public in accordance with the requirements of the Coal-Mine Inspection Act. Publication of the report comprised forwarding copies (1) to the operating company (2) to the national office of the United Mine Workers of America and the district office of the United Mine Workers, for mines organized by the agency, or to the officials directing the Progressive Mine Workers' organization, for the mines under their jurisdiction; and (3) to the chief of the State mine-inspection agency and the State mine inspector of the State inspection district in which the inspection was made. In addition, copies of all coal mine-inspection reports in the files of the Bureau of Mines, at the field offices as well as in Washington D. C., are available for public inspection at those offices.

As the Coal-Mine Inspection Act does not provide for the enforcement of recommendations, appreciable results can be derived through close cooperation with management, labor, and State mine-inspection agencies. The publicity

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given to inspection reports usually has considerable influence in obtaining compliance with recommendations; however, the most effective results are obtained by close personal contact with the industry and by convincing management, labor, and State enforcement agencies of the advantages of compliance with the recommendations and the sincere desire of the Federal inspectors to aid in reducing the number of accidents. In other words, the greatest degree of compliance with the Coal-Mine Inspection Act is obtainable (or, at any rate, was obtained during the war) by cooperation rather than by compulsion.

The first actual inspections of coal mines under the Federal Coal-Mine Inspections and Investigations Act were made during the week of December 1, 1941. Between December 1, 1941, and October 1, 1945, approximately 3,100 of the nearly 14,000 coal mines in the United States received initial inspections; these mines represent an annual coal production of 612,000,000 tons, or nearly 90 percent of the 1944 total production of 683,200,000 tons. In this period, 4,454 reinspections of coal mines were made following the initial inspection. Some of the mines received several reinspections during the period whereas others received only one. The 3,100 mines represented approximately 97 percent of all persons employed in the entire coal-mining industry in the United States. In addition to these inspections, 923 Mineral Production Security inspections and reinspections were made by coal-mine inspectors.

It is conservatively estimated that between December 1, 1941, and October 1, 1945, at least 250,000 of the recommendations made by the Federal inspectors had been placed in effect by the mining companies, and in the years 1943, 1944, and 1945 the coal mines of the United States achieved the lowest fatality rates in the history of the industry prior to those years. Moreover, during 1943, 1944, and 1945 the fatal-accident rate of the coal mines of the United States was consistently downward for the first time for any consecutive 3-year period in the history of coal mining in the United States.

The output of coal for three consecutive war years, 1942, 1943, and 1944, was, in round numbers, 1,977,000,000 tons, in the mining of which 4,228 lives were lost - a fatality rate of 2.138 per million tons produced. This output was almost equalled by one similar consecutive 3-year period (1916, 1917, and 1918) during World War I, when 1,919,700,000 tons (in round numbers) were produced with a loss of 7,502 lives - a fatality rate of 3.91 per million tons of coal produced.

If the fatality rate for 1916, 1917, and 1918 (3.91) had been in effect in 1942, 1943, and 1944, the output of those 3 years (1,977,000,000 tons) would have cost 7,730 lives instead of the 4,228 lives which were actually lost under the much safer mining procedures followed in 1942, 1943, and 1944. This indicates that during 1942, 1943, and 1944, when Federal coal-mine inspectors were actively engaged in inspecting mines and recommending safer practices and equipment, without enforcement power, there was a saving of 3,502 lives, as compared with what would have occurred under the much less safe 1916, 1917, and 1918 method of mining coal. This shows an annual saving of 1,167 lives under these safer procedures, brought about, at least in part, by the work of the Federal Coal-Mine Inspection Branch.

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The coal output of the United States in 1944 totaled 683,200,000 tons (the largest tonnage in any year up to that time), and 1,293 lives were lost in producing it. This gives a fatality rate of 1.893 persons killed per million tons of coal produced - by far the lowest, or best, fatality rate for coal mining in history up to that time; 1944 marks the first time that the coal-mine fatality rate has been less than 2.00 fatal accidents per million tons produced.

Coal-Mines Administration for War

Immediately following the President's order on May 1, 1943, taking possession and control of the coal-producing mines for the United States Government, J. J. Forbes, chief, Mineral Production Security Branch, Bureau of Mines, was appointed by Harold L. Ickes, Secretary of the Interior and Solid Fuels Administrator for War, to direct and supervise, as regional manager, operation of the mines in the anthracite region in Pennsylvania.

From the Bureau's personnel, Federal coal-mine inspectors, Federal mining, electrical, and explosives engineers, safety instructors from the Safety Branch of the Bureau of Mines, clerks and stenographers were assigned specific duties. Lists were made of all anthracite-producing companies with an output of more than 50 tons daily or more than 25 men employed. A detailed tabulation was made of all mine officials who had agreed to act as Federal operating managers for the United States and for their respective mines or operations. In all, 218 operations employing approximately 70,000 men and producing close to 200,000 tons of anthracite a day came under the jurisdiction of the regional manager.

Considerable opposition toward the Coal-Mine Inspection Bill was manifest before it was enacted. Some mine operators objected on the ground that such a law might impose restrictions on their operations. The bill was also opposed by various members of State Departments of Mines on the ground that it would result in duplication of effort, an objection that has proved to be invalid. The bill received the full support of the United Mine Workers of America, and this organization has since been active in obtaining additional funds to increase the inspection work.

The work of the Coal-Mine Inspection Branch has been conducted so that the objections raised by the mine owners and others have been overcome, at least in part, and many of these who formerly opposed the measure favored it by the end of the war.

That Federal coal-mine inspection was accorded considerable support and cooperation during the war is amply evidenced by hundreds of letters received from mine operators as well as mine workers and their representatives commending the work. Many of these letters come from mine operators who were definitely opposed to the idea of Federal inspection of mines before the act was passed by Congress. The number of outspoken criticisms received during the war is remarkably small; and although this does not prove that the work was or is popular, it does indicate that opponents have not pointed out many serious defects in the act or its administration during the war.

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The war record of the Coal-Mine Inspection Branch was one of definitely beneficial service to an industry essential to the successful prosecution of the war. Despite adverse conditions, the increased demands for coal were met, and manpower was conserved appreciably through a reduction in the occurrence of accidents. In conjunction with the many other safety activities of the Bureau of Mines, the Coal-Mine Inspection Branch exerted a very definite influence in bringing about coal-mining practices that safe-guarded mine workers and mining properties while making possible maximum production. By the wider adoption of modern engineering methods and proven safety measures and by more intensive safety education, better accident records and probably greater productivity were achieved during the war and can be achieved in the future.

Explosives Control Branch

Foreword

Shortly after the outbreak of hostilities in Europe on September 1, 1939, Dr. R. R. Sayers, director of the Bureau of Mines, recognizing the grave threat to the safety of the United States presented by that conflict, and also realizing the danger of sabotage by the use of explosives, inquired of the solicitor of the Department whether the Explosives Regulation Act of October 6, 1917, had been repealed. He was informed in an opinion dated December 14, 1939, that although the question was not entirely free from doubt, the Explosives Regulation Act was not repealed but was valid and existing legislation that was in a state of suspension and would not become operative unless and until the United States should be at war.

With this assurance by the solicitor that the act would be in effect upon declaration of war, Dr. Sayers caused it to be studied with a view to determining its applicability to conditions as they existed in the United States in early 1940. It was found that the security of the country demanded that the 1917 act be amended to make it operable during a state of national emergency, while the country was technically at peace, because of the numerous subversive agents operating in the United States with essentially unlimited access to explosives for purposes of sabotage unless somehow restrained. By June 7, 1940, shortly after the President's declaration of a threatened national emergency on May 25, 1940, a draft of a bill to revise the act of October 6, 1917, had been prepared in the Solicitor's Office of the Department of the Interior.

The bill was introduced into the House of Representatives just before the end of the 76th Congress on October 3, 1940. Failing of passage during the short time left before the end of the year, it was reintroduced the following year on February 3. Although the need for an amendment of the 1917 act was recognized in both houses of Congress, failure to agree upon certain changes delayed passage of the bill, and it had not been passed when the Japanese attacked Pearl Harbor on December 7, 1941.

The declaration of war on December 8, however, put into operation the 1917 act in its unrevised form, with its imperfections, including provisions defining "persons" as including citizens of the United States or allied

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countries, but not enemy aliens, and prohibiting all persons from handling explosives without a Federal license, thereby probably restricting United States citizens and friendly aliens but not enemy aliens in their use of explosives. The Bureau of Mines, which had been making plans for the administration of the revised act, was now confronted with the problems of setting up an administration that could function under the old or the new act, an almost impossible task in view of the changes in administrative details in the revision still before Congress. Just to cite two examples, the qualifications for licensing agents and the method for the appointment of investigators were entirely different in the two versions.

Finally, the Congress passed the Federal Explosives Act, it became law when signed by the President on December 26, 1941, and the Bureau of Mines was designated the agency to administer its provisions.

Organization

Because the organization of the Health and Safety Division of the Bureau of Mines was sufficiently flexible to adapt itself readily for the prompt and efficient handling of duties such as would be required for the administration of a nationwide explosives act, it was decided to place this function in the Health and Safety Division as the fourth Branch of the Division, under the direction of D. Harrington as chief. The new organization was designated the Explosives Control Branch.

G. W. Grove, an experienced mining engineer with a record of more than 20 years of service in mine safety work in the Bureau of Mines, was chosen as the chief engineer of the Explosives Control Branch when preliminary work was begun early in December 1941. He was still engaged in preliminary work on the organization of the proposed branch and assisting the attorneys of the Department in the framing of regulations, licenses, and other forms, etc., likely to be needed in the administration of the act when the declaration of war on December 8, 1941, automatically placed the act of 1917 in effect. With one act in effect and with a quite different act expected to become law any day, considerable confusion ensued in connection with matters pertaining to explosives, inasmuch as the Explosives Control Branch had not been actually formulated because no funds were available for the work. Long before funds were made available by an emergency allotment of $250,000 by the President shortly after January 1, 1942, there was a heavy demand from many sources for licenses, regulations, etc., by persons who realized that with the declaration of war the Federal Government automatically assumed rather direct control over matters pertaining to explosives.

The act empowered and required the formulation of regulations to effectuate the purposes of the act, and these regulations were given the effect of law, with drastic penalities for failure to observe them; it was therefore necessary that great care should be observed in framing the regulations. It was estimated that at least 1,000,000 people, scattered through scores of industrial activities in the United States, own, store, transport or use explosives in the United States; and the provisions of the regulations affect nearly all of these in some manner. The regulations were completed December 27, 1941.

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It was necessary that all persons engaged in the manufacture, sale, transportation, storage, or use of explosives should be supplied with a copy of the regulations as well as one of the act, hence it was necessary to have several hundred thousand copies of both available. The printing office was greatly overburdened with work during the early period of the war, and a sufficient number of copies of the act and the regulations under it were not available until about March 1, 1942. This greatly handicapped the work of trying to enforce the act.

A similar problem arose in connection with the preparation of the approximately 20 printed forms, all of which had to be framed to conform to conditions laid down in the act or in the regulations; some of these forms were required in quantities of 250,000 or more, and the effective enforcement of the act was almost out of the question until many of these forms, such as the license form, were available.

Following enactment of the act, the Secretary of the Interior authorized appointment of the necessary explosives investigators to enforce the act and the regulations under it. The Civil Service Commission registers for mining engineers, civil engineers, explosives engineers, and coal-mine inspectors were used in selecting appointees for the positions. These registers had been almost exhausted by other government agencies, and in order to obtain the full complement of 50 authorized, it was necessary to appoint some engineers not on the register but who were certified by the Civil Service Commission upon receipt of their applications. Most of the appointments were made in March 1942, and as appointments were completed, instructions were transmitted regarding the establishment of headquarters at designated localities throughout the country. After establishing headquarters, the investigators reported to the district offices of the Health and Safety Division of the Bureau of Mines to receive instructions from supervising engineers who had been placed in charge of the administrative work connected with the enforcement of the Federal Explosives Act and its regulations in their respective districts.

The Federal Explosives Act was designed particularly to aid in the prevention of sabotage in the United States by licensing the manufacture, sale, and possession of all explosives or the ingredients of explosives, to prevent the theft of explosives, and to promote greater safety in the manufacture, storage, and handling of explosives.

Duties of Investigators

The duties of investigators consisted in contacting and advising the newly appointed Federal explosives licensing agents in order to aid them in the correct methods of issuing Federal explosives licenses and to explain in detail the various duties of their positions. In those areas where no agents were available, it was the duty of the investigator to find some person who was eligible and willing to accept the position. Another duty was to contact law-enforcement officials of the Federal, State, County, and local governments in their territory, to make themselves known to such officials, to apprise these officials of the existence of the act and with its provision, and to seek their cooperation in enforcement of the act and the regulations issued

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under the act. As one of their most important duties, particularly because of its lasting effects, the investigators made numerous investigations and inspections of explosives storage facilities. Many thefts and explosives accidents were investigated as part of the duties of the Explosives Investigators under the provisions of the act and the regulations issued under it.

In May 1942 an outline of an official magazine inspection report was prepared, investigators were furnished with copies, and regular inspections of explosives storage facilities of licensees were started. The information required as to the magazine inspection report included the name, license number, and address of the licensee and details as to the construction and location of all magazines as well as other pertinent information on compliance and noncompliance with the act and its regulations. The investigator gave the licensee reasonable instructions on those conditions or procedures that were not in accord with the requirements of the act or the regulations and suggested other necessary improvements for safe storage, transportation, and handling of explosives. On July 15, 1942, a pamphlet entitled "Instructions for Storing, Handling, and Transporting Explosives" was published and distributed.

In October 1942, numerous amendments to the regulations indicated that it would be necessary to give additional instructions to the investigators. Accordingly, a conference of supervising engineers and field explosives investigators was held at the Pittsburgh station of the Bureau of Mines, where the men were advised regarding the new regulations and given further instructions relating to duties in the field in connection with licensing agents, inspections, and investigations pertaining to licenses, storage facilities, thefts, accidents and other matters concerning the act and regulations.

In order to obtain a more efficient coverage of all explosives storage facilities and to avoid duplication of Federal inspection work, as well as to prevent making recommendations of a contradictory nature by different Federal inspection agencies, the field personnel of the Safety, Coal-Mine Inspection, and Mineral Production Security Branches of the Health and Safety Division of the Bureau of Mines were authorized to make inspections and investigations under the provisions of the Explosives Act and the regulations under it.

These engineers and inspectors made only such inspections as were authorized by the supervising engineers in order to avoid duplication of work and were instructed to make inspections of explosives-storage facilities in underground mines as a part of other Federal inspections. The number of additional persons who thus became authorized representatives to aid in the enforcement of the act and the regulations under it was as follows: Safety Branch 50, Coal-Mine Inspection Branch 117, and Mineral Production Security Branch 75, a total of 242.

Administration

G. W. Grove was succeeded as chief engineer of the Explosives Control Branch by C. E. Nighman early in February 1942, and Mr. Nighman was succeeded

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by R. D. Leitch in July 1942 after having served as assistant chief engineer of the Branch since its establishment. Two supervising explosives investigators were appointed late in 1942 because of the necessity for maintaining correlation of the work of the field investigators; one had headquarters in Wilkes-Barre Pa., and supervised explosives control matters east of the Mississippi River and 6 States west of and adjacent to the river; the other supervisor had headquarters in Salt Lake City, Utah, and covered the remaining territory west of the Mississippi.

There were from two to four full- or part-time attorneys in the Washington office and two part-time attorneys in the field.

Administration of the act to the end of the fiscal year 1942 was by allocation of $250,000 that became available late in December of that year from the Emergency Fund of the President. For the following years regularly appropriated funds amounted to $540,000 for 1943, $530,000 for 1944, and $575,000 for 1945.

In addition to Bureau of Mines employees, there were 3,500 to 4,500 licensing agents, one or more in nearly every county in the United States, having authority to issue purchaser's, vendor's, and foreman's licenses. The Explosives Control Branch supervised and correlated their activities concerning the issuance of licenses and submission of reports by means of correspondence and visits by the approximately 50 field explosives investigators.

Licensing agents were appointed by the director of the Bureau of Mines and for some time, following completion of a "Personnel Security Questionnaire," the background of appointees was investigated by Army authorities.

By May 31, 1942, certificates of appointment and supplies had been sent to 4,348 licensing agents. For 6 months thereafter the total number of licensing agents continued to increase, until by November 30, 1942, the total reached 4,495 appointees, the greatest number active at any time. By October 1, 1945, a total of 6,853 appointments had been made, of which 3,840 were active on October 1, 1945.

From February 1942 to October 1, 1945, 25,029 requests for supplies from licensing agents had been filled, an average of 600 requests per month, and $1,814.27 had been expended for air-mail postage stamps used to send supplies to agents in those cases where it was indicated that forms were urgently needed. It had also been the practice to supply all agents in Alaska, Canal Zone, Hawaii, Puerto Rico, and the Virgin Islands at all times via air mail or air express. About 50 requests were filled weekly from individuals and firms for copies of the Federal Explosives Act and regulations thereunder.

After Germany surrendered in May 1945, the internal security of our country improved, and Congress appropriated a smaller sum of money for carrying out the requirements of the Federal Explosives Act for the fiscal year beginning July 1, 1945. All but nine of the explosives investigators in the field were notified 30 days in advance that their employment would cease at the close of business July 28. With insufficient funds for travel for the investigators, enforcement of the act virtually stopped.

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Shortly after Japan indicated willingness, in August 1945, to accept Allied surrender terms, particularly after V-J day (September 2, 1945), the Washington office received many inquiries from the field offices, licensing agents, and licensees concerning the possible discontinuance of licensing requirements for the control of explosives and the specified ingredients thereof as prescribed by the act.

Even though the war at that time, for practical purposes, was over and actual hostilities with Germany and Japan had ceased, the requirements of the act and of the regulations issued thereunder still remained in effect.

On September 19, 1945, telegrams were sent to the remaining nine field explosives investigators, and a memorandum was sent to the Explosives Control Branch's Washington and College Park personnel stating that explosives control activities would formally terminate at the close of business October 19, 1945, and that their employment in the branch would cease at that time.

Inquiries continued to arrive at the Washington office relative to relaxation of licensing requirements, the expected Presidential proclamation to suspend the operation of the act's requirements was not issued, and in order to relieve the situation the Director of the Bureau of Mines issued General License No. 8 on October 5, 1945. A reprint of the General License was sent to each field office and licensing agent. It relieved persons requiring a Federal explosives license from applying for or obtaining an individual license. Such persons were covered by the General License, but all the requirements of the act and the regulations were still in effect, except that individual licenses were not required and need not be issued. The operation of the act was officially suspended on July 25, 1947, by the signing of Public Law 239, 80th Congress, by President Truman.

Reports of Inspections

During the period May 1942 to October 1, 1945, explosives investigators and other authorized representatives of the Bureau of Mines submitted 48,000 explosives-storage inspection reports covering 27,000 original inspections and 21,000 reinspections. The inspections included magazines used by vendors of explosives, manufacturers of explosives, companies engaged in mining coal and ore, logging, oil and oil prospecting, farmers engaged in clearing land and ditching, prospectors, construction companies engaged in building airports, roads, dams, buildings, and other structures, quarries, and many other operations that own or use explosives.

The magazine reports submitted by the field men were reviewed by engineers in the Washington office. Substandard conditions were noted, and a form letter was transmitted to the licensee calling attention to these conditions· the licensee was advised to make the necessary improvements indicated in the letter and to advise the Washington office of compliance. Many of the reports reviewed showed adequate construction and compliance that did not require any action, and in many instances reinspections of storage facilities either showed partial or full compliance where recommendations had been made. In those cases wherein explosives-storage facilities were wholly inadequate, special letters were transmitted requiring immediate compliance or compliance within a stated time interval. Special attention was given to those magazines reported to have been entered illegally, and numerous cases were reported, many if not most of the offenders being boys generally less than 18 years old.

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Cooperation with State Agencies

In the last months of 1940, the drafting committee of the Council of State Governments began consideration of State legislation to increase national security in cooperation with the agencies of the Federal Government. One of the measures taken up was a model State Explosives Act, towards the language of which representatives of the Solicitor's Office of the Department of the Interior and the Bureau of Mines gave helpful suggestions. In 1941 and early 1942 the act was adopted in the form of statutory law or regulation by 17 States. Thus, the career of cooperation with the States in the enforcement of explosives legislation began even before the approval of the Federal Explosives Act.

Soon after the act went into effect, it was apparent that many local problems of administration and enforcement could best be solved by consultation between State and Federal explosives authorities. At the request of the Bureau of Mines, transmitted through the Council of State Governments, the governors of 41 States, in the spring of 1942, appointed collaborators with whom representatives of the Bureau of Mines could discuss explosives-control matters and cooperate in the administration of Federal and State acts.

To assist the field representatives of the Bureau of Mines to become acquainted with the explosives laws of the States to which they were assigned, the Bureau of Mines in July 1943 issued Information Circulars 7251, 7252, 7253, 7254, and 7255 summarizing the explosives laws of all the States. This extensive survey was initiated at the suggestion of D. Harrington, chief of the Health and Safety Division of the Bureau of Mines, in the fall of 1941; the actual work was done by lawyers in the Solicitor's Office of the Department of the Interior.

Violations of the Act

The Department of the Interior reported 132 cases involving violations of the Federal Explosives Act to the Department of Justice up to October 1, 1945. Because its program in the administration of the act was primarily educational, the institution of criminal proceedings was recommended by the Department of the Interior only in cases where circumstances were such as to indicate disloyalty or hostility to the United States, a reckless disregard for the act, or failure to comply with the act and regulations after repeated warnings. Prosecution was not recommended in cases involving juvenile violators, because the flexibility of State juvenile delinquency laws afforded more adequate treatment of such cases than was possible under the act. In addition to the cases reported to the Department of Justice by the Department of the Interior, United States attorneys had instituted criminal proceedings upon some direct requests of the Federal Bureau of Investigation in cases investigated by its agents independently of the Bureau of Mines.

There were 39 known convictions under the act, for which fines in varying amounts up to $500 and prison sentences up to the maximum of 1 year were imposed. In addition, four persons were convicted of a conspiracy to violate the act and were sentenced to imprisonment for 2 years. The total fines amounted to $18,061.

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In all, Specifications of Charges for revocation of license were filed in 75 cases before October 1, 1945, and licenses were revoked in 71 cases, 11 of which were suspended pending compliance. The number of revocation proceedings decreased with the increased respect of the person using explosives for the act and its administration.

Comments on the Federal Explosives Act

The requirements of the act were mandatory immediately upon its approval. Operation without a license was, at least technically, a violation of the act after December 26, but compliance was impossible. The application, license, and other forms necessary for the administration of the act prepared at the same time as the regulations, were in the hands of the printers, and would not be ready for distribution until some time in February. Thousands of licensing agents had to be designated throughout the country, and before designation it was necessary to ascertain their authority to administer oaths. Even after their appointment they could not begin to function until they had received adequate supplies of the forms still at the printers and copies of the act and regulations for their own use and distribution to licensees.

One problem that caused much difficulty since the inception of the Federal Explosives Act and resulted in numerous amendments to the regulations was the matter of regulations concerning ingredients of explosives. Even with the definition of ingredients of explosives limited to phosphorus and active oxidizing agents, the use of ingredients is so widespread that strict enforcement of the act would require every doctor, pharmacist, butcher, and farmer, every school in which chemistry courses were given, as well as every factory that maintained a laboratory, not to mention every householder who kept a stocked medicine chest, to have a Federal explosives license.

Sodium nitrate or ammonium nitrate used as fertilizers or sodium chlorate used as a weed eradicator are extremely active oxidizing agents and usable for making explosives and also are used in huge quantities by farmers. The regulation of these ingredients caused much difficulty, and in case of another war matters pertaining to them should be given careful consideration.

The subject of fireworks also caused numerous amendments to the regulations as well as the issuance of two general licenses.

In addition to the difficulties mentioned with regard to ingredients of explosives and fireworks and failure to provide in advance for actual administrative procedures and supplies to effectuate the administration of the act, there have been numerous experiences that have required action of some kind, caused temporary inconvenience or friction, and have provided data of use in the future administration of the present act or acts of a more or less similar nature that may follow it.

The act specifies five types of licenses and defines their scope. It has been impossible to control the issuance of hundreds of thousands of licenses so as to insure that the proper types of licenses have been issued, and it is now thought that one Federal explosives license should be sufficient.

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The act specifies that licenses shall not be valid for more than 1 year. The necessity for license renewal annually has caused much criticism, an enormous amount of work, and serious loss of time, besides a waste of critical materials without contributing much if anything to the security of the country that could not have been realized by carefully and efficiently issued licenses good for "the duration" unless sooner terminated or revoked for cause. The licensing agents generally have been State or county officials, many of them so overburdened with their regular work and other obligations of a war that they have neither the time nor the inclination to inform themselves properly concerning the regulations or to conform to prescribed procedure is issuing licenses.

Almost any changes in procedure causing additional work in connection with issuing licenses resulted in a number of resignations or threats to resign on the part of the licensing agents.

Licensing agents should be Federal employees, preferably well known locally (for example, postmasters) but whose main interests and loyalties are more than local and whose tenure of office does not depend on their local political constituents.

Large numbers of persons (for example, farmers) have been able to obtain desired materials defined as ingredients of explosives in any necessary quantity without individual licenses, whereas thousands of others, no less loyal and experienced, have had to obtain licenses for only a few ounces of the same materials. This situation resulted in many complaints of inconsistency and discrimination and is more or less inherent in the inclusion of ingredients in the act or the regulations.

The act is weak in its provision for enforcement of regulations governing explosives in transit in wartime, as the responsibility rested with two Government agencies - the Bureau of Mines and the Interstate Commerce Commission - and neither had the facilities for assuming the enormous inspection burden resulting from the use of trucks for transportation.

The act is inherently weak in its protection against theft and illegal use of explosives for sabotage or other illicit purposes. A licensee could could steal explosives, and if they were properly stored thereafter and proper records maintained it is doubtful if any conviction could be obtained, except under State or local law, either for the theft or later use. Moreover, a saboteur could easily obtain a license if he had no previous record that might cause him to be suspected as a dangerous person or even if he had such record but the licensing agent had no information concerning it.

Reluctance of the United States attorneys to prosecute flagrant violators of the Federal Explosives Act, or especially of the regulations, and of judges or juries to impose any but light sentences in the relatively few instances when violators have been brought to trial has been very discouraging to others besides Bureau of Mines field forces who worked diligently to discover the culprit and to present the evidence. Persons who have been concerned with matters pertaining to the possession, storage, handling, and use of explosives

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have been extremely careless in normal times, and it is difficult to convince people in general that a careless practice of normal times may become a criminal or near criminal act in time of war or other emergency.

Conclusion

No clear-cut case of sabotage with explosives was disclosed in the United States during the war other than a very few instances of slight damage or attempted damage by disgruntled individuals to try to avenge personal grudges against other individuals. There was a notable lack of use of explosives for subversive purposes during World War II and the period immediately preceding it, as contrasted with what occurred during World War I.

Credit for the lack of sabotage by the use of explosives cannot be limited to administration of the Federal Explosives Act, because excellent work was done by other organizations, such as some State and municipal agencies, the various service commands of the armed forces, and the Federal Bureau of Investigation, whose officers and field agents have been diligent in their own activities and with whom representatives of the Explosives Control Branch worked in close and harmonious relations both in reporting matters of mutual interest and actively assisting each other in investigations. The Institute of Makers of Explosives appointed a committee of three to cooperate with the Bureau of Mines in the administration of the act, and the committee functioned actively and effectively. The office of the Provost Marshal General took a keen and sympathetic interest in the administration and enforcement of the act, and the active constructive aid given by the officers of the Provost Marshal General's office helped much to make the act effective.

Thousands of storage facilities of explosives have been improved either by constructing new magazines or by changing existing magazines so as to make them as secure against theft as possible. Besides the obvious protection thus provided for the security of the country as a whole, the storage requirements have prevented much waste of material in providing weather-proof structures with proper drainage and ventilation, which help to prevent deterioration of the explosives in storage, as happens frequently in make-shift storage in normal times. Some vendors have voluntarily reported a reduction in the cost of explosives to the purchasers because of the elimination of deteriorated explosives returned for credit.

Although the legal authority conferred by the act in enforcement of personal safety has been in question, great improvement in safety connected with explosives has been effected owing to administration of the act. The inherent danger of loose practices has been emphasized by Bureau of Mines representatives as a whole, who have not failed to point out desirable practices as the opportunities were presented, and who have obtained a measure of adherence by friendly advice. Much definitely valuable educational work on the use of explosives not only during war but in time of peace has thus been accomplished and direct instruction has been given to individuals and groups, including the military and police and fire departments.

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Experience and knowledge gained during the period of administering the wartime Federal Explosives Act have shown the need for a drastic Federal act designed for emergency and wartime control of explosives and for another, less exacting in certain of its provisions, for peace. The need for a wartime act framed with better control provisions than the present Federal act is obvious; the need for a peacetime Federal act is equally urgent because of failure of some States to have regulations pertaining to explosives and also because of the lack of uniformity and indifferent enforcement of some of the separate State acts, all of which handicap manufacturers and vendors of explosives, safety engineers, and other agencies in trying to remedy the inexcusable indifference in the storage, handling, and use of explosives that is causing loss of life, many disabling accidents, and much property damage annually in the United States.

The wartime act should provide that it can be placed in partial effect in advance of a national emergency, so that its provisions could be understood by those affected in the emergency. It should provide the funds required to assemble such essential material as forms, regulations, etc., so that it could be put into active operation almost immediately upon declaration of an emergency or war.

A peacetime act also could serve excellently not only for controlling explosives in normal times but in providing a skeleton organization of trained personnel, which could be expanded quickly in case of emergency, having knowledge of current problems, the objectives to be attained, and the most effective means of achieving them. One of the desirable provisions of a peacetime Federal Explosives Act would be the certification of all users of explosives as to their competency to handle and use explosives safely.

Because of the remarkably effective work of the Federal Bureau of Investigation, the Army and Navy Intelligence Division, and other law-enforcement and espionage-prevention agencies in the months, even years, prior to Pearl Harbor, this country was comparatively free from active professional saboteurs. Had the contrary been true, as it was prior to our entry into World War I, great and perhaps irreparable damage might have been done to our war industries. Our national security would have been seriously jeopardized also, as explosives, most frequently the tool of the saboteur, could have been obtained readily in the period of nearly 6 months that would elapse between our entry into the war and the time of obtaining an effective licensing system under the Explosives Act. This was the earliest the act could be made fully effective after belated passage by Congress after hostilities had started, although presented to the Congress over a year earlier.

General Eisenhower, in his final report as Chief of Staff, upon retirement on February 14, 1948, stated "action in the next war may well be decisive in the first 60 days", and also, "While war still remains a possibility we must not neglect defenses against attacks from any direction and by any weapon, including sabotage."

If events should prove either of these statements true, an Explosives Control Act that would start to function even as soon as 2 months after an

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atomic war began would be completely futile, and if pre-war sabotage of our defenses against attack is to be prevented, explosives and the ingredients from which they can easily be made must be under strict control at the first sign of belligerency on the part of any nation.

Mineral Production Security Branch

Foreword

From July 1, 1942, to June 30, 1945, the safeguarding of mines and related facilities to prevent subversive activities from interfering with the extraction and processing of minerals was largely the responsibility of the Mineral Production Security Branch of the Health and Safety Division of the Bureau of Mines in cooperation with the Office of the Provost Marshal General and other agencies of the armed forces. Nearly 3,000 mines or related facilities essential to the prosecution of the war were inspected by engineers of this branch, and effective measures for the prevention of sabotage were recommended to the operators to assure maintenance of desirable and necessary security standards. It is not possible to say how far the activities of the Branch were responsible for the results obtained, but the fact remains that there were no known cases of sabotage in the mines of the United States during the war years.

The Mineral Production Security Branch was formed in cooperation with the Office of Civilian Defense and made effective on July 1, 1942, to carry out an Executive Order of the President with respect to minerals and related facilities. The organizational set-up and procedure were formulated by D. Harrington, Chief of the Health and Safety Division of the Bureau of Mines, upon receiving instructions from the director of the Bureau of Mines to handle the new activity as an additional activity of the Health and Safety Division. In this program the Bureau cooperated with the Office of the Provost Marshal General, the Office of Civilian Defense, the officials of the nine Service Commands, the Federal Bureau of Investigation, the Office of Naval Intelligence, the Military Intelligence Division of the Army, and other similar agencies.

Although the Mineral Production Security Branch was organized as part of a program of the Office of Civilian Defense to supplement the internal-security service of the War Department during 1943, the Bureau of Mines' engineers in this Branch assisted the inspectors of the War Department in inspections of mines and related facilities under the jurisdiction of the War Department, and most of its work was done in close cooperation with officials of the Provost Marshal General's office, especially Col. George K. Englehart and Major Herman Hooper.

After July 1, 1944, the Mineral Production Security Branch was given the sole responsibility for security inspections of the mines and related facilities, which were currently rated by the Resources Protection Board of the War Production Board.

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Engineers of the Mineral Production Security Branch investigated mines and related facilities and discussed the security deficiencies encountered with the management. Recommendations were offered orally and in writing to assist the operation officials in maintaining an adequate standard of security.

Executive Order 9165, formally establishing the Mineral Production Security Branch, was signed May 19, 1942.

Organization

The allotment of funds, $550,000, was appropriated in Public Law 528, April 28, 1942.

J. J. Forbes, appointed to head the new branch, and his assistants, W. J. Fene and S. H. Ash, assumed their new duties in Washington, D. C., where headquarters for the Mineral Production Security Branch were established in the Health and Safety Division under D. Harrington on July 1, 1942. Under Civil Service regulations, 15 senior mining engineers and 56 mining engineers were selected and appointed to report for duty in July 1942. The personal history of each engineer was investigated by the Army Intelligence before appointment. After training, the engineers were assigned to duty in the field under the supervision and direction of the supervising engineers and engineers in charge of the Health and Safety District and Subdistrict offices with a view of trying to assure the effectiveness of the work and the avoidance of duplication of effort or clashing with those engaged in somewhat similar work for other branches of the Health and Safety Division.

Training of Personnel

Although all appointees were experienced mining engineers, a special training course was instituted at the Pittsburgh, Pa., station representatives from the War Department and the Federal Bureau of Investigation assisted in training them in modern sabotage. The training in criminal investigation presented at the Provost Marchal General's School, Fort Oglethorpe, Ga., was summarized into a series of lectures for the men. Owing to the importance of fire as a subversive weapon, the Bureau of Mines obtained the assistance of Frank L. Ahern, National Park Service, Chairman on Health and Safety of the Department of the Interior, who presented a comprehensive course on the prevention and control of fire losses. Members of the Health and Safety Division of the Bureau of Mines gave instruction on methods of preventing as well as controlling underground fires, based on years of experience in fighting mine fires. Additional subjects covered in this intensive training of the 71 field engineers included the following:

War training of personnel
Legal aspect of Federal Explosives Act
Criminal-investigation training
What is fire, and causes of explosions
Handling and testing of explosives
Mine gases
War gases

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First-aid training
Coal-mine fires and explosions
Metal-mine fires
Metal-dust explosions and incendiary bombs
Gas masks
Oxygen breathing apparatus
Dust and air samples and analysis

The results accomplished subsequently by these engineers in the field is indicative that their training in the essentials of their work was complete.

Operating Procedure

Inspections were made to assist management in preventing loss of production from subversive activities, fires, or accidents. An inspection outline was prepared for use by the Bureau engineers to assure uniformity in making inspections. The outline form was based on the Federal Bureau of Investigation requirements of employee citizenship records, on the War Department requirements of proper guarding of surface installations, on standard requirements for fire protection, and on the Bureau of Mines Tentative Standards for Coal and Metal Mines.

The inspection of a mine or related facility took 1 to 5 days, depending on its size. The engineers were required to inspect the surface plant and underground working faces and haulageways and to investigate the company records of employees. The engineers discussed with the operating officials the problems presented. In determining the security status of a facility, the engineers considered measures taken or needed to prevent the entrance of saboteurs, to prevent effective action once a saboteur had gained entrance, and to prevent unintentional damage by fire, accidents, or otherwise.

Methods of storing, handling, and transporting explosives were studied carefully; the instructions and regulations issued under the Federal Explosives Act of December 26, 1941, were taken as a basis by the Mineral Production Security engineers for determining whether safe practices were being followed in the storage of explosives. An explosives magazine report was made covering each magazine examined. This was done for the Explosives Control Branch to avoid duplication of effort and yet obtain information needed by both agencies.

The Mineral Production Security engineers were not vested with the police power to enforce compliance with suggested recommendations, and the operators were invited to comment on suggestions or means of improving recommendations made by the inspectors. The Executive Order stressed the primary responsibility of the operators to maintain production of materials needed for the war. The engineers attempted to convince the operators that voluntary compliance with the recommendations would insure maximum production.

As integral parts of each survey, the engineers had conferences with the local fire departments, law-enforcement officers, and State police officials, and acted as liaison officers, where necessary, to strengthen the bonds between the local organizations in their efforts to combat subversive activities.

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After a plant survey was completed, the engineer prepared a supplemental narrative report in which a picture of the actual conditions existing in the mine or plant was presented and a list of the suggested recommendations for improving hazardous conditions was included. This report was transmitted to the operator by Mr. Harrington, acting for the Director of the Bureau of Mines.

Information regarding subversive groups and suspicious aliens was reported directly to the Federal Bureau of Investigation and was not included in the supplemental reports sent to the operators of mineral facilities. Mineral Production Security reports were considered confidential information, and the reports were not published.

At the request of the War Department, Bureau of Mines engineers assisted in the inspections of mineral facilities on the Army Master Responsibility List. A procedure for joint inspections was formulated after conferences between Bureau of Mines officials and representatives from the Office of the Provost Marshal General: the army inspector was given the responsibility for the surface security status of mines and related facilities; the Mineral Production Security engineer was given the responsibility for the underground security status.

Field Activities of the Branch

The statistical division of the Bureau of Mines was able to furnish information on 7,329 mines and related facilities active in the United States during 1941. The Mineral Production Security Branch did not attempt to investigate or inspect all these facilities, but concentrated its efforts on those of major importance in producing or processing minerals required for the successful prosecution of the war. These minerals were grouped in four classes of relative importance - strategic, critical, essential, and important. The facilities in each mineral group were screened according to the relative size of the facilities. The classification was subject to changes due to an increase or a decrease in the production of any particular mine or in the available stock piles of that mineral or in the demand for the mineral. Under such a classification even small mines in the strategic group were inspected, whereas only the largest mines in the important group were worthy of attention; thus, the total figure of 7,329 facilities was later reduced to 3,742 by the elimination of facilities of relatively little importance to the war program.

The War Department retained the responsibility for the security status of the most vital mineral facilities, and joint inspections were made by Army and Bureau of Mines inspectors of most of these properties. A total of 337 mines and related facilities under the jurisdiction of the Internal Security Division of the War Department were included in the War Department's confidential Master Responsibility Lists, which were revised as the importance of facilities increased or decreased.

Mineral Production Security surveys were started in August 1942 by the field force of engineers trained during July. A total of 2,911 mines and related facilities were inspected during the 3-year period August 1, 1942, to June 30, 1945; of these, 301 were facilities on the Army Master Inspection Responsibility List and were inspected jointly with Inspectors of the Internal Security Division.

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Recurring inspections, as directed by the original Executive Order and the War Department, were made of 1,052 facilities. A total of 1,598 reinspections of mines and related facilities were made during the 3-year period, as some facilities on the Army List were reinspected several times.

Record of inspections and reinspections, August 1, 1942, to June 30, 1945

Type of facility	Inspections	Reinspections	Total
Underground coal mines	1359	344	1703
Stripping coal mines	51	20	71
By-product plants, coal	11	1	12
Underground metal mines	601	573	1174
Open pits, etc., metal mines	172	149	321
Mills at metal mines	152	136	288
Smelters	31	121	152
Underground nonmetallic mines	165	140	305
Quarries, etc., nonmetallic mines	255	65	320
Surface plants, nonmetallic mines	114	49	163

The safeguarding of explosives is directly related to the prevention of sabotage, and the elimination of loss of production due to accidents. When surveying mineral facilities, Mineral Production Security engineers investigated the storage, handling, and use of explosives, and, in addition to including this information in the Mineral Production Security supplemental reports, made individual reports to the Explosives Control Branch of the Health and Safety Division on 6,916 explosives storage magazines. The latter procedure was adopted to prevent duplication of effort by engineers of the Mineral Production Security Branch and the Explosives Investigators of the Explosives Control Branch.

On July 31, 1942, the Bureau of Mines was requested to use all reasonable effort to find scrap metal and at the same time to prevent the scrapping of useful mining machinery. Accordingly, the supervising engineers of the Health and Safety Division were instructed to have the engineers of the Mineral Production Security Branch assist representatives of the War Production Board in finding scrap metal in operating as well as abandoned mines, to determine whether the material, especially machinery, could be utilized for operation purposes by suitable repairs or alterations. During the three years, 530 salvage scrap investigations were made by Mineral Production Security engineers.

Coal-Mine Inspections

Mineral Production Security engineers inspected coal mines with experienced inspectors of the Coal-Mine Inspection Branch to learn the methods used by that Division, and trained the inspectors of the Coal-Mine Inspection Branch in the methods used in making a Mineral Production Security inspection. This was done to obviate the necessity of two employees of the same government agency visiting a coal mine, one to make a Coal-Mine Inspection Branch report and one to make a Mineral Production Security report. During the 3 years, 171 original inspections and 85 reinspections of coal mines were made by Mineral Production Security engineers for the Coal-Mine Inspection Branch of the Health and Safety

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Division. Inspectors of the Coal-Mine Inspection Branch reciprocated by making 655 original inspections and 296 reinspections for the Mineral Production Security Branch.

Mine Fires and Explosions

An important activity of the Bureau of Mines has been the study of mine fires and explosions. Engineers of the Mineral Production Security Branch cooperated with other members of the Health and Safety Division in conducting the recovery work and fire fighting at 7 major and 13 minor mine disasters and participated in the investigations of 24 other underground fires and explosions and 42 surface fires and explosions. In these accidents, 225 lives were lost and 104 persons were injured.

Miscellaneous Accidents

The loss of production due to accidents caused the Mineral Production Security engineers to investigate accidents that came to their attention. Reports were made of 73 accidents involving 88 deaths and 39 injured.

Cooperation of the Mineral Industry

The need for assisting operators of mining facilities is very clearly shown by a study of the 4,509 reports submitted by the Mineral Production Security engineers. A few large mining properties had instituted guard and watchmen service and had well-organized and equipped fire departments, but with these exceptions the lack of thought given to such protection was appalling in such critical times. The attitude that sabotage or fire could not affect one's own property was almost nationwide. The individual surveys and the emphasizing to each operator his responsibility in war times to provide needed protection at specific parts of his plant resulted in a definite change of this attitude by many operators of mines or mineral plants throughout the country. The ingenuity shown by Mineral Production Security engineers in helping management to find practical solutions for each particular problem justified the care taken in selecting the engineers for this service.

Cooperation of the mineral industry was essential for completion of a security program, because security measures usually required the expenditure of funds by the operators and owners. The response of the mining industry to the assistance offered by the Bureau of Mines was excellent. Some criticism was received, especially if the engineer failed to consider all sides of a problem before offering a suggestion, but most of the letters received from mining companies not only expressed a desire to follow the recommendations offered but invited the Bureau's engineers to revisit their facilities and expressed their appreciation of the service rendered.

Sabotage and other subversive activities were effectively prevented in the mineral industry during the war, at least in part, by the efforts of the Mineral Production Security Branch, though fundamentally the burden was on the industry itself. All mines susceptible to subversive action were surveyed, and recurring inspections were made to insure the adoption of precautionary measures by the mine operators.

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Field inspectors of the Office of Civilian Defense visited many facilities following surveys by Mineral Production Security engineers and investigated the action taken by management in compliance with the recommendations made during the surveys. The investigators found that over two-thirds of the recommendations had been complied with and generally only lack of material or shortage of labor had prevented compliance with the greater part of the other third.

The 1,598 reinspection reports made by the Mineral Production Security Branch engineers show that nearly 70 percent compliance with recommendations was obtained throughout the country.

As an indication of the effectiveness of the work of the Mineral Production Security Branch, one inspection and one reinspection were made early in 1943 of eight relatively extensive deep metal mines operated by one company. The original inspection reports on these 8 mines had in them 291 recommendations. Reinspections were made in the fall of 1943, and it was found that 186 of the 291 recommendations, or 64 percent, had been adopted in full; 58, or 20 percent, were adopted in part; and 47, or 16 percent, were not adopted. Of the 47 recommendations not placed in effect, conditions on 8 had changed so as to make the recommendations inapplicable, the operators did not concur in 21 of the recommendations, and no action was taken or statement made in connection with 18.

The adoption, in whole or in part, of 244 out of 291 original recommendations, or 84 percent, speaks well for the efficiency of the inspections and also for the cooperative spirit of the 8 mine operators who placed the 244 recommendations in effect.

Most of the recommendations made by the Mineral Production Security engineers produced permanent benefits to the mines and plants for which they were made, chiefly because many such mines and plants had not previously been inspected by competent engineers.

Elimination of fire hazards and provision of means for fighting fires are permanent improvements, even though the war crisis has passed. Fire-fighting crews have been organized and trained, and first-aid fire-fighting equipment has been installed where none previously existed. Small fires extinguished by employee fire crews contrast with large conflagrations that destroyed mills and surface plants. Prompt action by a few trained employees before a fire can gain headway is more effective than the efforts of a municipal fire department called too late. Unusable fire hose and rusted hydrants have been replaced with serviceable equipment, and inadequate water lines have been replaced by larger pipes.

Interest in safety and accident prevention was aroused to such an extent that Bureau of Mines engineers were invited to present lectures to keymen on safety. Formal accident-prevention classes were organized, and the company supervisory officials who attended these courses were awarded certificates by the Bureau of Mines.

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Improvement in working conditions in the mines was stressed. Healthful atmospheres underground are a direct means of increasing production as well as preventing sickness among the employees. Ventilation studies were undertaken by some companies, and a sincere effort was made to improve underground working conditions.

Thousands of tons of scrap metal were located by Mineral Production Security engineers, who in some instances assisted in the safe removal of scrap iron from abandoned mines.

Many thousand dollars worth of usable mine machinery was diverted from scrap piles and made available to mine operators by the investigations of Bureau of Mines engineers.

Conclusions as to the Work of the Mineral Production Security Branch

The defeat of Germany permitted the War Department to suspend much of its internal-security program, and on May 8, 1945, its cooperative agreement with the Bureau of Mines was terminated officially. Following conferences between representatives of the Office of the Provost Marshal General and the Bureau of Mines, the field personnel of the Bureau of Mines was notified on June 8, 1945, that the activities of the Mineral Production Security Branch had been terminated.

There was virtually no known sabotage in the mines of the United States in World War II. The work of the Mineral Production Security Branch was of an educational preventive nature, assisting mineral facilities to take suitable precautionary action, and good results were obtained. As there was no known sabotage, it is difficult to state how much was actually prevented, but a few acts of sabotage in strategic plants might have seriously crippled the war program at least temporarily.

Letters from the Office of Civilian Defense, Office of the Provost Marshal General, War Department, and the mineral industry testify to the effectiveness of the work of the Mineral Production Security Branch and to its efficient administration, and there is good reason to believe that expenditures made in the work of the Branch during its approximately 3 years of existence were well justified.

CONCLUSIONS

With the advent of World War II, the Health and Safety Division (then designated Health and Safety Branch) was quickly expanded about fivefold in personnel and funds and, instead of having two branches (then designated divisions), it became an organization of five branches by July 1, 1942. The funds for coal-mine inspections alone amounted to more than twice the amount that had been allotted for the entire division before the war, and the funds for the Explosives Control Branch amounted to considerably more than had ever been given the entire Health and Safety Division previously. This situation was also true as to the funds provided for the Mineral Production Security Branch.

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The Explosives Control Branch and the Mineral Production Security Branch were both purely war agencies, and both were conducted in very close cooperation with the armed forces in Washington and the field.

The three new branches of the Health and Safety Division had to be organized and personnel recruited at a time when manpower was at a premium, and this, together with the urgency of the particular types of work done by the Explosives Control and Mineral Production Security Branches, was of an extremely emergency nature in the early days of the war; pressure of various kinds for prompt action was extreme. The district set-up of the Health and Safety Division, especially of the Safety Branch, was such that it lent itself admirably to handle their new and in some ways totally different types of activity with a minimum of confusion and delay, even though at times pressure of various kinds and urgency was exerted.

The result was all that could be expected, and every one of the five branches of the Health and Safety Division acquitted itself admirably during the war; the strictly war agencies were adjourned promptly with the end of the war, no effort being made to perpetuate them. Notwithstanding the latter fact, there is great need for a peacetime Federal explosives act to supersede the present wartime act (now recessed), the proposed peacetime act to license all users of explosives who do blasting, to see that explosives are manufactured, transported, and stored in a reasonably safe manner, and to provide that it may be expanded quickly in case of war (or an emergency before war), and with teeth far beyond the provisions of the present act, which lacks much of being either strong or complete. The war operations of the five branches of the Health and Safety Division not only aided materially in the prosecution of the war but they also added much experiences and information, some of which was translated into numerous publications of benefit in the prevention of accidents and ill health in the mining and allied industries in peacetime as well as in war.

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